Final report for Study of coal in India's future energy scene

Volume II - Annexures

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Annexures

Annexure 2.1 Power

This annexure describes all the assumptions made to create various scenarios for determining coal demand by power.

The scenarios created are combinations of all the below given assumptions. The coal demand under all the scenarios are presented in tables under each growth scenario. To the final coal demand there is a 3% transit loss added for each scenario.
D – Total power demand in million kWh.

T&D losses

T1 – Faster decline in T&D losses in all the regions and all achieve a figure of 15% in the terminal year of analysis (2020-21).
T2- Slower decline in T&D in all the regions as indicated by the past trends.

Share of coal based generation

S1- Increasing share of coal based generation in the eastern region (as indicated by the past trends) and declining share in all the other regions.
S2- Increasing share of hydro and nuclear in all the regions

Auxiliary consumption

A1 – Declining auxiliary consumption in all the regions.
A2 – Higher and constant auxiliary consumption in all the regions (over time).

Specific coal consumption

C1 – In all the regions the specific coal consumption decreases linearly to reach a figure of 0.66 in all the regions by the terminal year.
C2 – No regional differentiation in the specific coal consumption and a norm of 0.71kg/ kWh continues.

High growth scenario (7% rate of growth of GDP)

Table 1 Forecasts of the power demand (billion kWh)

Year	North	South	East	West	North-east	Total
1999/2000	98.31	99.65	122.64	37.27	2.28	360.16
2000/01	106.14	107.95	128.92	39.91	2.45	385.38
2001/02	114.74	117.26	136.26	43.02	2.64	413.92
2002/03	123.81	126.63	143.10	46.41	2.83	442.79
2003/04	133.55	136.63	150.23	50.12	3.04	473.56
2004/05	144.02	147.28	157.65	54.19	3.27	506.40
2005/06	155.28	158.65	165.37	58.65	3.51	541.46
2006/07	167.43	170.78	173.45	63.50	3.78	578.94
2011/12	244.12	243.39	218.08	96.24	5.40	807.23
2016/17	369.21	343.82	271.82	148.19	7.60	1140.65
2020/21	500.73	444.33	321.42	207.17	9.89	1483.55

Table 2 Coal demand (million tonnes)

	1999/2000	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2011/12	2016/17	2020/21
DT1S1A1C1	265	278	296	312	328	346	366	388	498	648	786
DT1A1S1C2	246	262	280	297	314	334	355	379	504	679	845
DT1S1A2C1	266	280	298	314	332	350	370	393	509	666	809
DT1S1A2C2	247	263	282	299	318	338	360	385	515	697	870
DT1S2A1C1	213	226	237	245	253	263	274	288	345	458	564
DT1S2A1C2	197	213	224	233	242	253	267	282	350	480	607
DT1S2A2C1	213	228	239	247	255	266	278	292	353	471	581
DT1S2A2C2	198	214	226	235	244	257	270	286	358	493	625
DT2S1A1C1	265	279	294	310	329	347	367	390	505	648	811
DT2S1A1C2	246	262	277	295	316	335	357	382	511	679	872
DT2S1A2C1	266	281	296	313	333	351	372	396	516	666	834
DT2S1A2C2	247	264	280	298	319	339	362	388	522	697	898
DT2S2A1C1	212	227	236	244	254	264	276	290	350	468	583
DT2S2A1C2	197	213	222	232	243	254	268	284	354	490	627
DT2S2A2C1	213	228	237	246	256	267	280	295	358	481	600
DT2S2A2C2	197	214	224	234	245	258	272	288	363	504	645
Minimum	197	213	222	232	242	253	267	282	345	458	564
Maximum	266	281	298	314	333	351	372	396	522	697	898

Medium growth scenario (6% rate of growth of GDP)

Table 3 Forecasts of the power demand (billion kWh)

	North	South	West	East	NEast	Total
1999/2000	96.09	96.25	122.16	33.94	2.24	350.69
2000/01	103.23	103.47	128.43	35.92	2.40	373.45
2001/02	111.09	111.57	135.74	38.13	2.57	399.09
2002/03	119.36	119.61	142.58	40.47	2.75	424.76
2003/04	128.23	128.14	149.70	42.95	2.94	451.97
2004/05	137.77	137.19	157.12	45.60	3.15	480.83
2005/06	148.01	146.79	164.86	48.41	3.37	511.45
2006/07	159.09	156.99	172.95	51.38	3.62	544.03
2011/12	229.03	216.93	217.71	69.39	5.09	738.14
2016/17	344.66	297.85	271.68	93.52	7.05	1014.76
2020/21	466.09	376.35	321.55	117.74	9.06	1290.79

Table 4 Coal demand (million tonnes)

	1999/2000	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2011/12	2016/17	2020/21
DT1S1A1C1	258	269	285	298	312	327	343	362	451	566	665
DT1A1S1C2	239	253	269	284	299	315	334	354	456	592	715
DT1S1A2C1	259	270	287	301	315	331	348	368	461	581	684
DT1S1A2C2	240	254	271	286	302	319	338	360	466	608	736
DT1S2A1C1	207	219	228	234	240	249	258	270	315	405	487
DT1S2A1C2	192	206	216	223	230	240	251	264	319	424	523
DT1S2A2C1	207	220	230	237	243	252	262	274	322	416	501
DT1S2A2C2	192	207	217	225	233	243	255	268	326	436	539
DT2S1A1C1	257	269	282	297	313	328	345	365	457	566	686
DT2S1A1C2	239	253	267	282	300	317	336	357	462	592	738
DT2S1A2C1	258	271	284	299	316	332	350	370	467	581	706
DT2S1A2C2	239	253	267	282	300	317	336	357	462	593	738
DT2S2A1C1	206	219	227	234	241	250	260	272	319	414	503
DT2S2A1C2	191	206	214	222	231	241	252	266	323	434	541
DT2S2A2C1	207	221	228	236	244	253	263	276	326	425	518
DT2S2A2C2	192	207	216	224	233	244	256	270	330	446	557
Minimum	191	206	214	222	230	240	251	264	315	405	487
Maximum	259	271	287	301	316	332	350	370	473	608	760

Low growth scenario (5% rog of GDP)

Table 5 Forecasts of the power demand (billion kWh)

	North	South	West	East	NEast	Total
1999/2000	93.90	92.93	121.66	35.57	2.20	346.27
2000/01	100.40	99.12	127.65	37.66	2.35	367.17
2001/02	107.56	106.08	134.66	40.17	2.51	390.97
2002/03	115.08	112.89	141.17	42.90	2.68	414.71
2003/04	123.15	120.08	147.94	45.88	2.85	439.90
2004/05	131.83	127.68	154.98	49.14	3.04	466.67
2005/06	141.17	135.70	162.31	52.73	3.24	495.15
2006/07	151.27	144.19	169.96	56.61	3.48	525.50
2011/12	215.34	193.24	212.04	83.03	4.82	708.45
2016/17	323.07	258.13	262.45	125.29	6.59	975.53
2020/21	436.37	319.29	308.75	173.06	8.39	1245.86

Table 6 Coal demand (million tonnes)

LOW	1999/2000	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2011/12	2016/17	2020/21
DT1S1A1C1	255	265	280	292	305	319	334	352	437	553	657
DT1A1S1C2	236	249	264	278	292	307	324	344	442	579	707
DT1S1A2C1	256	267	282	294	308	322	339	357	447	568	676
DT1S1A2C2	237	250	266	280	295	311	329	349	452	595	728
DT1S2A1C1	204	216	224	230	235	242	251	261	303	390	471
DT1S2A1C2	189	203	212	218	225	233	244	255	306	409	507
DT1S2A2C1	205	217	226	232	237	245	254	265	309	401	485
DT1S2A2C2	190	204	213	220	227	236	247	259	313	420	521
DT2S1A1C1	254	266	277	291	306	320	336	354	443	553	679
DT2S1A1C2	236	250	262	276	293	309	326	346	448	579	730
DT2S1A2C1	255	267	279	293	309	324	341	360	453	568	699
DT2S1A2C2	237	251	264	279	296	312	331	352	458	595	752
DT2S2A1C1	204	216	223	229	236	243	252	263	307	399	487
DT2S2A1C2	189	203	210	217	225	234	245	257	310	418	524
DT2S2A2C1	205	218	224	231	238	246	256	267	313	410	501
DT2S2A2C2	190	204	212	219	228	237	248	261	317	429	539
Minimum	189	203	210	217	225	233	244	255	303	390	471
Maximum	256	267	282	294	309	324	341	360	458	595	752

Table 7 Input data for power demand forecast (North _high)

Years	GDPA (millions)	GDPI (millions)	GDPS (millions)	DC (MU)	AC (MU)	IC (MU)	SC (MU)	CI	Ratio	POP (millions)
1970-71	116151	19754	79146	1013	1614	5702	1222			140
1971-72	107619	20016	83644	1095	1799	6098	1284			141
1972-73	108610	21262	84311	1180	2181	6250	1445			144
1973-74	108015	21429	84996	1305	2384	6158	1575			147
1974-75	110977	22077	85848	1403	2832	5729	1626			150
1975-76	124605	30972	95423	1682	3578	7350	2071			154
1976-77	127853	26113	102571	1913	4013	8982	1923			158

Years	GDPA (millions)	GDPI (millions)	GDPS (millions)	DC (MU)	AC (MU)	IC (MU)	SC (MU)	CI	Ratio	POP (millions)
1977-78	136854	29230	108834	1986	4304	8145	2197	102.2	53.05	162
1978-79	139927	32087	114652	2245	5531	9807	2290	144.4	54.48	166
1979-80	112762	32655	119884	2418	6341	9398	2433	145.8	56.58	170
1980-81	141651	34098	122754	2658	6651	9582	2472	147.2	58.49	177
1981-82	148620	37014	127764	3039	6935	11329	2878	149.2	59.02	181
1982-83	152381	43331	136634	3751	8106	10654	3507	147.8	61.59	186
1983-84	163875	47246	139332	4047	8375	11742	4010	150.4	60.98	190
1984-85	162366	48619	144635	4588	9441	11824	4029	150.4	61.08	195
1985-86	166958	54526	156958	5307	9419	13528	4553	151.2	62.54	200
1986-87	166823	56689	172405	5892	11833	14633	5005	152.1	63.01	204
1987-88	160164	63200	181024	6191	14257	14510	5701	148.9	65.10	209
1988-89	196213	73375	200311	7228	14777	16761	6420	154.8	61.27	213
1989-90	194565	76843	214736	9550	17279	18432	6067	153.6	65.80	218
1990-91	211070	82716	226018	10192	18131	18969	6920	155.1	66.10	224
1991-92	210331	83265	231294	11844	20517	19567	7089	155.6	66.72	228
1992-93	216762	85918	239806	13318	22046	20995	8474	157.1	69.63	233
1993-94	213886	89309	249100	14581	23301	20521	9450	156.1	69.73	238
1994-95	230188	95479	260445	15997	23880	22102	10275	156.7	69.89	242
1995-96	226925	103411	274321	16350	24247	22863	10879	157.3	71.07	246
1996-97	238384	110860	297738							247
1997-98	250368	118820	323084							252
1998-99	262896	127323	350510							257
1999-00	275992	136406	380183							262
2000-01	289678	146105	412279							267
2001-02	303977	156461	446989							273
2002-03	318914	167514	484518							278
2003-04	334515	179311	525087							283
2004-05	350805	191898	568933							289
2005-06	367812	205326	616313							295
2006-07	385563	219648	667500							301
2007-08	404089	234922	722791							307
2008-09	423419	251206	782503							313
2009-10	443585	268565	846977							319
2010-11	464618	287066	916581							325
2011-12	486552	306782	991710							332
2012-13	509423	327787	1072787							338
2013-14	533266	350163	1160268							345
2014-15	558117	373995	1254643							352
2015-16	584017	399374	1356438							367
2016-17	611004	426395	1466218							374
2017-18	639120	455160	1584590							381
2018-19	668408	485777	1712206							388
2019-20	698912	518359	1849767							396
2020-21	730679	553029	1998023							403

Table 8 Input data for power demand forecast (North_medium)

Years	GDPA (millions)	GDPI (millions)	GDPS(millions)	DC(MU)	AC(MU)	IC(MU)	SC(MU)	CI	Ratio	POP (millions)
1970-71	116151	19754	79146	1013	1614	5702	1222			140
1971-72	107619	20016	83644	1095	1799	6098	1284			141
1972-73	108610	21262	84311	1180	2181	6250	1445			144
1973-74	108015	21429	84996	1305	2384	6158	1575			147
1974-75	110977	22077	85848	1403	2832	5729	1626			150
1975-76	124605	30972	95423	1682	3578	7350	2071			154
1976-77	127853	26113	102571	1913	4013	8982	1923			158
1977-78	136854	29230	108834	1986	4304	8145	2197	102.2	53.05	162
1978-79	139927	32087	114652	2245	5531	9807	2290	144.4	54.48	166
1979-80	112762	32655	119884	2418	6341	9398	2433	145.8	56.58	170
1980-81	141651	34098	122754	2658	6651	9582	2472	147.2	58.49	177
1981-82	148620	37014	127764	3039	6935	11329	2878	149.2	59.02	181
1982-83	152381	43331	136634	3751	8106	10654	3507	147.8	61.59	186
1983-84	163875	47246	139332	4047	8375	11742	4010	150.4	60.98	190
1984-85	162366	48619	144635	4588	9441	11824	4029	150.4	61.08	195
1985-86	166958	54526	156958	5307	9419	13528	4553	151.2	62.54	200
1986-87	166823	56689	172405	5892	11833	14633	5005	152.1	63.01	204
1987-88	160164	63200	181024	6191	14257	14510	5701	148.9	65.10	209
1988-89	196213	73375	200311	7228	14777	16761	6420	154.8	61.27	213
1989-90	194565	76843	214736	9550	17279	18432	6067	153.6	65.80	218
1990-91	211070	82716	226018	10192	18131	18969	6920	155.1	66.10	224
1991-92	210331	83265	231294	11844	20517	19567	7089	155.6	66.72	228
1992-93	216762	85918	239806	13318	22046	20995	8474	157.1	69.63	233
1993-94	213886	89309	249100	14581	23301	20521	9450	156.1	69.73	238
1994-95	230188	95479	260445	15997	23880	22102	10275	156.7	69.89	242
1995-96	226925	103411	274321	16350	24247	22863	10879	157.3	71.07	246
1996-97	236748	109796	294392							247
1997-98	246957	116556	315879							252
1998-99	257563	123712	338880							257
1999-00	268582	131286	363497							262
2000-01	280026	139302	389838							267
2001-02	291912	147783	418022							273
2002-03	304253	156756	448171							278
2003-04	317065	166246	480419							283
2004-05	330365	176284	514905							289
2005-06	344169	186898	551780							295
2006-07	358493	198120	591204							301
2007-08	373356	209984	633347							307
2008-09	388775	222524	678389							313
2009-10	404770	235777	726524							319
2010-11	421358	249781	777955							325
2011-12	438560	264577	832903							332
2012-13	456396	280208	891598							338
2013-14	474887	296718	954289							345

Years	GDPA (millions)	GDPI (millions)	GDPS(millions)	DC(MU)	AC(MU)	IC(MU)	SC(MU)	CI	Ratio	POP (millions)
2014-15	494056	314155	1021237							352
2015-16	513923	332568	1092724							367
2016-17	534512	352010	1169046							374
2017-18	555846	372535	1250520							381
2018-19	577950	394202	1337484							388
2019-20	600849	417070	1430295							396
2020-21	624569	441203	1529334							403

Table 9 Input data for power demand forecast (North_low)

Years	GDPA (millions)	GDPI (millions)	GDPS(millions)	DC (MU)	AC (MU)	IC (MU)	SC (MU)	CI	Ratio	POP (millions)
1970-71	116151	19754	79146	1013	1614	5702	1222			140
1971-72	107619	20016	83644	1095	1799	6098	1284			141
1972-73	108610	21262	84311	1180	2181	6250	1445			144
1973-74	108015	21429	84996	1305	2384	6158	1575			147
1974-75	110977	22077	85848	1403	2832	5729	1626			150
1975-76	124605	30972	95423	1682	3578	7350	2071			154
1976-77	127853	26113	102571	1913	4013	8982	1923			158
1977-78	136854	29230	108834	1986	4304	8145	2197	102.2	53.05	162
1978-79	139927	32087	114652	2245	5531	9807	2290	144.4	54.48	166
1979-80	112762	32655	119884	2418	6341	9398	2433	145.8	56.58	170
1980-81	141651	34098	122754	2658	6651	9582	2472	147.2	58.49	177
1981-82	148620	37014	127764	3039	6935	11329	2878	149.2	59.02	181
1982-83	152381	43331	136634	3751	8106	10654	3507	147.8	61.59	186
1983-84	163875	47246	139332	4047	8375	11742	4010	150.4	60.98	190
1984-85	162366	48619	144635	4588	9441	11824	4029	150.4	61.08	195
1985-86	166958	54526	156958	5307	9419	13528	4553	151.2	62.54	200
1986-87	166823	56689	172405	5892	11833	14633	5005	152.1	63.01	204
1987-88	160164	63200	181024	6191	14257	14510	5701	148.9	65.10	209
1988-89	196213	73375	200311	7228	14777	16761	6420	154.8	61.27	213
1989-90	194565	76843	214736	9550	17279	18432	6067	153.6	65.80	218
1990-91	211070	82716	226018	10192	18131	18969	6920	155.1	66.10	224
1991-92	210331	83265	231294	11844	20517	19567	7089	155.6	66.72	228
1992-93	216762	85918	239806	13318	22046	20995	8474	157.1	69.63	233
1993-94	213886	89309	249100	14581	23301	20521	9450	156.1	69.73	238
1994-95	230188	95479	260445	15997	23880	22102	10275	156.7	69.89	242
1995-96	226925	103411	274321	16350	24247	22863	10879	157.3	71.07	246
1996-97	235112	108732	291046							247
1997-98	243566	114313	308754							252
1998-99	252296	120167	327503							257
1999-00	261308	126306	347350							262
2000-01	270611	132744	368357							267
2001-02	280213	139494	390591							273
2002-03	290123	146570	414119							278
2003-04	300350	153988	439015							283
2004-05	310902	161763	465356							289

Years	GDPA (millions)	GDPI (millions)	GDPS(millions)	DC (MU)	AC (MU)	IC (MU)	SC (MU)	CI	Ratio	POP (millions)
2005-06	321788	169912	493221							295
2006-07	333019	178452	522697							301
2007-08	344604	187399	553873							307
2008-09	356552	196774	586844							313
2009-10	368874	206595	621709							319
2010-11	381580	216883	658574							325
2011-12	394681	227658	697549							332
2012-13	408189	238943	738752							338
2013-14	422113	250761	782304							345
2014-15	436466	263134	828336							352
2015-16	451259	276090	876984							367
2016-17	466505	289653	928392							374
2017-18	482215	303850	982712							381
2018-19	498404	318711	1040101							388
2019-20	515083	334264	1100730							396
2020-21	532266	350541	1164775							403

Table 10 Input data for power demand forecast (South_high)

Years	GDPA (millions)	GDPI (millions)	GDPS(millions)	DC (MU)	AC(MU)	IC (MU)	SC (MU)	CI	POP (millions)
1970-71	89278	26598	74349	851	1929	7781	1359		134.0
1971-72	91728	27740	77717	950	2204	8422	1342		135.3
1972-73	90075	28588	78895	976	2362	8144	1158		137.9
1973-74	77117	28545	82121	1068	2570	8317	1385		140.8
1974-75	91291	29256	81777	1218	2960	8198	1424		143.8
1975-76	98848	31658	87155	1389	2777	9759	1581		146.8
1976-77	91986	35068	90036	1558	2999	10351	1801		149.8
1977-78	100606	36602	97312	1699	3079	10815	1972	115.7	152.8
1978-79	102945	40660	101614	1901	3413	12584	1821	115.7	155.6
1979-80	97082	47146	103826	2257	3608	12363	2018	115.1	158.6
1980-81	92382	42916	105928	2572	3859	13062	2171	114.6	163.4
1981-82	106349	44478	112734	2961	4049	14912	2207	115.1	166.3
1982-83	99480	47869	115339	3328	4596	14142	2576	113.9	169.3
1983-84	105190	48580	119323	3694	4500	14663	3001	115.4	172.8
1984-85	108983	52971	126097	4603	5613	17948	2821	116.7	176.3
1985-86	103452	53585	137624	4782	6833	17387	2576	116.4	179.4
1986-87	103215	52445	140166	5177	8996	18001	2993	116.1	182.7
1987-88	107913	55714	153447	6172	9968	16534	3588	116.7	186.3
1988-89	120408	64982	166036	6891	11323	19249	4250	117.5	188.9
1989-90	125227	66094	180622	7850	12555	21652	3982	118.6	192
1990-91	124927	70726	192029	8452	15214	22028	4683	118.4	194.9
1991-92	135667	70396	200384	9191	16596	22904	4880	119.7	196.8
1992-93	137069	72124	208035	10108	19015	23699	5576	120.4	199.8
1993-94	149095	76821	229151	11108	21526	24968	6157	120.6	201.7
1994-95	151841	80342	253188	12175	25330	26957	6704	120.4	205.5
1995-96	153222	84797	266378	13157	26318	26840	6877	119.8	208.4

Years	GDPA (millions)	GDPI (millions)	GDPS(millions)	DC (MU)	AC(MU)	IC (MU)	SC (MU)	CI	POP (millions)
1996-97	160579	90691	288434						211.2
1997-98	168256	96975	312253						213.6
1998-99	176264	103673	337971						216.0
1999-00	184616	110811	365734						218.5
2000-01	193325	118418	395699						221.0
2001-02	202406	126522	428036						224.3
2002-03	211872	135154	462924						226.6
2003-04	221739	144348	500561						229.0
2004-05	232020	154137	541155						231.4
2005-06	242733	164560	584931						233.8
2006-07	253894	175655	632131						236.2
2007-08	265519	187464	683015						238.4
2008-09	277626	200030	737862						240.7
2009-10	290233	213401	796970						242.9
2010-11	303359	227625	860662						245.2
2011-12	317024	242755	929282						247.6
2012-13	331248	258847	1003201						249.6
2013-14	346051	275959	1082817						251.6
2014-15	361456	294152	1168556						253.7
2015-16	377484	313494	1260878						258.0
2016-17	394159	334053	1360273						259.7
2017-18	411505	355904	1467270						261.4
2018-19	429548	379125	1582434						263.1
2019-20	448312	403799	1706374						264.6
2020-21	467824	430013	1839742						266.7

Table 11 Input demand for power demand forecast (South_medium)

Years	GDPA (millions)	GDPI (millions)	GDPS (millions)	DC(MU)	AC(MU)	IC(MU)	SC(MU)	CI	POP (millions)
1970-71	89278	26598	74349	851	1929	7781	1359		134.0
1971-72	91728	27740	77717	950	2204	8422	1342		135.3
1972-73	90075	28588	78895	976	2362	8144	1158		137.9
1973-74	77117	28545	82121	1068	2570	8317	1385		140.8
1974-75	91291	29256	81777	1218	2960	8198	1424		143.8
1975-76	98848	31658	87155	1389	2777	9759	1581		146.8
1976-77	91986	35068	90036	1558	2999	10351	1801		149.8
1977-78	100606	36602	97312	1699	3079	10815	1972	115.7	152.8
1978-79	102945	40660	101614	1901	3413	12584	1821	115.7	155.6
1979-80	97082	47146	103826	2257	3608	12363	2018	115.1	158.6
1980-81	92382	42916	105928	2572	3859	13062	2171	114.6	163.4
1981-82	106349	44478	112734	2961	4049	14912	2207	115.1	166.3
1982-83	99480	47869	115339	3328	4596	14142	2576	113.9	169.3
1983-84	105190	48580	119323	3694	4500	14663	3001	115.4	172.8
1984-85	108983	52971	126097	4603	5613	17948	2821	116.7	176.3
1985-86	103452	53585	137624	4782	6833	17387	2576	116.4	179.4
1986-87	103215	52445	140166	5177	8996	18001	2993	116.1	182.7

Years	GDPA (millions)	GDPI (millions)	GDPS (millions)	DC(MU)	AC(MU)	IC(MU)	SC(MU)	CI	POP (millions)
1987-88	107913	55714	153447	6172	9968	16534	3588	116.7	186.3
1988-89	120408	64982	166036	6891	11323	19249	4250	117.5	188.9
1989-90	125227	66094	180622	7850	12555	21652	3982	118.6	192
1990-91	124927	70726	192029	8452	15214	22028	4683	118.4	194.9
1991-92	135667	70396	200384	9191	16596	22904	4880	119.7	196.8
1992-93	137069	72124	208035	10108	19015	23699	5576	120.4	199.8
1993-94	149095	76821	229151	11108	21526	24968	6157	120.6	201.7
1994-95	151841	80342	253188	12175	25330	26957	6704	120.4	205.5
1995-96	153222	84797	266378	13157	26318	26840	6877	119.8	208.4
1996-97	159528	89849	285283						211.2
1997-98	166069	95187	305484						213.6
1998-99	172851	100827	327066						216.0
1999-00	179884	106786	350120						218.5
2000-01	187175	113079	374743						221.0
2001-02	194732	119726	401038						224.3
2002-03	202565	126745	429116						226.6
2003-04	210683	134156	459093						229.0
2004-05	219094	141980	491093						231.4
2005-06	227809	150238	525250						233.8
2006-07	236837	158955	561703						236.2
2007-08	246189	168154	600602						238.4
2008-09	255874	177861	642106						240.7
2009-10	265905	188103	686385						242.9
2010-11	276291	198907	733618						245.2
2011-12	287044	210304	783996						247.6
2012-13	298177	222325	837724						249.6
2013-14	309700	235002	895017						251.6
2014-15	321628	248370	956104						253.7
2015-16	333973	262465	1021231						258.0
2016-17	346748	277324	1090656						259.7
2017-18	359966	292989	1164657						261 4
2018-19	373643	309500	1243526						263.1
2019-20	387792	326903	1327574						264.6
2020-21	402429	345242	1417134						266.7

Table 12 Input data for power demand forecast (South_low)

Years	GDPA (millions)	GDPI (millions)	GDPS(millions)	DC(MU)	AC(MU)	IC(MU)	SC(MU)	CI	POP (millions)
1970-71	89278	26598	74349	851	1929	7781	1359		134.0
1971-72	91728	27740	77717	950	2204	8422	1342		135.3
1972-73	90075	28588	78895	976	2362	8144	1158		137.9
1973-74	77117	28545	82121	1068	2570	8317	1385		140.8
1974-75	91291	29256	81777	1218	2960	8198	1424		143.8
1975-76	98848	31658	87155	1389	2777	9759	1581		146.8
1976-77	91986	35068	90036	1558	2999	10351	1801		149.8
1977-78	100606	36602	97312	1699	3079	10815	1972	115.7	152.8
1978-79	102945	40660	101614	1901	3413	12584	1821	115.7	155.6
1979-80	97082	47146	103826	2257	3608	12363	2018	115.1	158.6
1980-81	92382	42916	105928	2572	3859	13062	2171	114.6	163.4
1981-82	106349	44478	112734	2961	4049	14912	2207	115.1	166.3
1982-83	99480	47869	115339	3328	4596	14142	2576	113.9	169.3
1983-84	105190	48580	119323	3694	4500	14663	3001	115.4	172.8
1984-85	108983	52971	126097	4603	5613	17948	2821	116.7	176.3
1985-86	103452	53585	137624	4782	6833	17387	2576	116.4	179.4
1986-87	103215	52445	140166	5177	8996	18001	2993	116.1	182.7
1987-88	107913	55714	153447	6172	9968	16534	3588	116.7	186.3
1988-89	120408	64982	166036	6891	11323	19249	4250	117.5	188.9
1989-90	125227	66094	180622	7850	12555	21652	3982	118.6	192
1990-91	124927	70726	192029	8452	15214	22028	4683	118.4	194.9
1991-92	135667	70396	200384	9191	16596	22904	4880	119.7	196.8
1992-93	137069	72124	208035	10108	19015	23699	5576	120.4	199.8
1993-94	149095	76821	229151	11108	21526	24968	6157	120.6	201.7
1994-95	151841	80342	253188	12175	25330	26957	6704	120.4	205.5
1995-96	153222	84797	266378	13157	26318	26840	6877	119.8	208.4
1996-97	158477	89007	282132						211.2
1997-98	163895	93416	298787						213.6
1998-99	169480	98032	316390						216.0
1999-00	175236	102866	334995						218.5
2000-01	181169	107927	354656						221.0
2001-02	187283	113225	375432						224.3
2002-03	193583	118770	397384						226.6
2003-04	200074	124574	420575						229.0
2004-05	206762	130648	445074						231.4
2005-06	213651	137005	470953						233.8
2006-07	220748	143656	498285						236.2
2007-08	228058	150615	527151						238.4
2008-09	235586	157896	557633						240.7
2009-10	243338	165512	589820						242.9
2010-11	251321	173478	623804						245.2
2011-12	259541	181811	659682						247.6
2012-13	268004	190525	697557						249.6
2013-14	276717	199638	737536						251.6

Years	GDPA (millions)	GDPI (millions)	GDPS(millions)	DC(MU)	AC(MU)	IC(MU)	SC(MU)	CI	POP (millions)
2014-15	285686	209167	779732						253.7
2015-16	294918	219130	824266						258.0
2016-17	304420	229547	871263						259.7
2017-18	314200	240437	920855						261.4
2018-19	324264	251821	973181						263.1
2019-20	334621	263720	1028389						264.6
2020-21	345278	276157	1086631						266.7

Table 13 Input data for power demand forecast (West_high)

Years	GDPA (millions)	GDPI (millions)	GDPS (millions)	DC (MU)	AC(MU)	IC(MU)	SC(MU)	CI	ratio	POP (millions)
1970-71	87975	40030	78266	1123	827	9184	1722			118
1971-72	92653	40663	80578	1199	919	9842	2089			119
1972-73	71640	43853	82390	1245	1239	10419	2155			121
1973-74	87052	45872	85672	1310	1242	10817	2028			124
1974-75	86478	47359	87879	1521	1839	11413	2173			127
1975-76	100022	49209	93795	1663	1842	11941	2440			131
1976-77	95106	55405	97390	1849	2070	13160	2960			133
1977-78	105980	59587	104413	2067	2328	14263	3246	111.2	13.65	136
1978-79	105490	65219	110659	2269	2774	15392	3595	111.9	14.19	140
1979-80	95845	67067	111876	2549	2928	15577	3520	112.3	14.32	143
1980-81	105494	68181	116705	2802	3403	16313	3653	112.7	14.93	148
1981-82	113733	66450	121811	3068	3589	17498	3896	114.8	15.06	152
1982-83	107711	71584	131237	3502	4319	17801	4032	112.9	15.87	154
1983-84	119509	81239	137424	3856	4526	20421	4308	115.3	16.16	158
1984-85	114953	76869	144813	4408	5702	22160	4689	113.4	16.77	161
1985-86	110069	86962	157351	4984	6161	24144	4898	113.5	17.44	165
1986-87	100013	93072	165434	5780	7301	25399	5382	113.5	17.61	169
1987-88	103636	94651	174369	6826	9443	25841	5955	115.1	18.11	173
1988-89	132320	108554	191528	7568	11005	27751	6343	113.8	17.59	176
1989-90	138879	120476	210199	8743	12354	27500	6792	119.6	18.04	179
1990-91	141212	133029	223475	9447	14808	30077	7201	119.5	20.17	184
1991-92	118363	119648	241548	10388	18789	31477	7750	116.0	21.82	188
1992-93	152810	147116	262073	11376	19631	30898	8275	118.5	22.38	191
1993-94	149842	156252	288767	11954	23267	33933	9273	120.1	23.90	195
1994-95	159372	180433	307966	12916	27152	35697	9570	119.7	24.86	199
1995-96	154293	203033	328370	14520	32043	37825	10466	119.2	26.18	202
1996-97	161545	216935	355215						30.54	206
1997-98	169111	231750	384192						31.24	209
1998-99	177003	247538	415467						31.95	212
1999-00	185233	264359	449216						32.65	215
2000-01	193816	282279	485630						33.36	218
2001-02	202765	301366	524914						34.07	223
2002-03	212094	321695	567289						34.77	226
2003-04	221819	343343	612992						35.48	229
2004-05	231955	366393	662277						36.18	232

Years	GDPA (millions)	GDPI (millions)	GDPS (millions)	DC (MU)	AC(MU)	IC(MU)	SC(MU)	CI	ratio	POP (millions)
2005-06	242518	390932	715418						36.89	235
2006-07	253525	417053	772711						37.60	239
2007-08	264994	444855	834470						38.30	242
2008-09	276941	474443	901037						39.01	245
2009-10	289386	505928	972777						39.71	248
2010-11	302349	539426	1050082						40.42	251
2011-12	315848	575064	1133375						41.13	254
2012-13	329906	612973	1223109						41.83	257
2013-14	344543	653293	1319770						42.54	260
2014-15	359782	696174	1423883						43.24	263
2015-16	375646	741773	1536009						43.95	266
2016-17	392160	790257	1656751						44.66	269
2017-18	409347	841803	1786759						45.36	272
2018-19	427234	896600	1926729						46.07	275
2019-20	445849	954846	2077407						46.77	277
2020-21	465218	1016753	2239599						47.48	280

Table 14 Input data for power demand forecast (West_medium)

Years	GDPA (millions)	GDPI (millions)	GDPS (millions)	DC(MU)	AC(MU)	IC(MU)	SC(MU)	CI	ratio	POP (millions)
1970-71	87975	40030	78266	1123	827	9184	1722			118
1971-72	92653	40663	80578	1199	919	9842	2089			119
1972-73	71640	43853	82390	1245	1239	10419	2155			121
1973-74	87052	45872	85672	1310	1242	10817	2028			124
1974-75	86478	47359	87879	1521	1839	11413	2173			127
1975-76	100022	49209	93795	1663	1842	11941	2440			131
1976-77	95106	55405	97390	1849	2070	13160	2960			133
1977-78	105980	59587	104413	2067	2328	14263	3246	111.2	13.65	136
1978-79	105490	65219	110659	2269	2774	15392	3595	111.9	14.19	140
1979-80	95845	67067	111876	2549	2928	15577	3520	112.3	14.32	143
1980-81	105494	68181	116705	2802	3403	16313	3653	112.7	14.93	148
1981-82	113733	66450	121811	3068	3589	17498	3896	114.8	15.06	152
1982-83	107711	71584	131237	3502	4319	17801	4032	112.9	15.87	154
1983-84	119509	81239	137424	3856	4526	20421	4308	115.3	16.16	158
1984-85	114953	76869	144813	4408	5702	22160	4689	113.4	16.77	161
1985-86	110069	86962	157351	4984	6161	24144	4898	113.5	17.44	165
1986-87	100013	93072	165434	5780	7301	25399	5382	113.5	17.61	169
1987-88	103636	94651	174369	6826	9443	25841	5955	115.1	18.11	173
1988-89	132320	108554	191528	7568	11005	27751	6343	113.8	17.59	176
1989-90	138879	120476	210199	8743	12354	27500	6792	119.6	18.04	179
1990-91	141212	133029	223475	9447	14808	30077	7201	119.5	20.17	184
1991-92	118363	119648	241548	10388	18789	31477	7750	116.0	21.82	188
1992-93	152810	147116	262073	11376	19631	30898	8275	118.5	22.38	191
1993-94	149842	156252	288767	11954	23267	33933	9273	120.1	23.90	195
1994-95	159372	180433	307966	12916	27152	35697	9570	119.7	24.86	199

Years	GDPA (millions)	GDPI (millions)	GDPS (millions)	DC(MU)	AC(MU)	IC(MU)	SC(MU)	CI	ratio	POP (millions)
1995-96	154293	203033	328370	14520	32043	37825	10466	119.2	26.18	202
1996-97	160509	214949	351380						30.54	206
1997-98	166955	227536	375958						31.24	209
1998-99	173638	240831	402206						31.95	212
1999-00	180568	254872	430235						32.65	215
2000-01	187753	269701	460163						33.36	218
2001-02	195200	285358	492115						34.07	223
2002-03	202919	301890	526225						34.77	226
2003-04	210919	319342	562635						35.48	229
2004-05	219209	337765	601495						36.18	232
2005-06	227800	357211	642967						36.89	235
2006-07	236701	377734	687221						37.60	239
2007-08	245923	399392	734441						38.30	242
2008-09	255476	422246	784819						39.01	245
2009-10	265371	446359	838563						39.71	248
2010-11	275620	471799	895891						40.42	251
2011-12	286235	498637	957037						41.13	254
2012-13	297228	526945	1022250						41.83	257
2013-14	308611	556804	1091794						42.54	260
2014-15	320397	588294	1165950						43.24	263
2015-16	332600	621503	1245017						43.95	266
2016-17	345233	656521	1329313						44.66	269
2017-18	358311	693443	1419177						45.36	272
2018-19	371848	732371	1514969						46.07	275
2019-20	385859	773409	1617070						46.77	277
2020-21	400360	816670	1725889						47.48	280

Table 15 Input data for power demand forecast (West_low)

Years	GDPA (lmillion)	GDPI (million)	GDPS (million)	DC (MU)	AC (MU)	IC (MU)	SC (MU)	CI	ratio	POP (millions)
1970-71	87975	40030	78266	1123	827	9184	1722			118
1971-72	92653	40663	80578	1199	919	9842	2089			119
1972-73	71640	43853	82390	1245	1239	10419	2155			121
1973-74	87052	45872	85672	1310	1242	10817	2028			124
1974-75	86478	47359	87879	1521	1839	11413	2173			127
1975-76	100022	49209	93795	1663	1842	11941	2440			131
1976-77	95106	55405	97390	1849	2070	13160	2960			133
1977-78	105980	59587	104413	2067	2328	14263	3246	111.2	13.65	136
1978-79	105490	65219	110659	2269	2774	15392	3595	111.9	14.19	140
1979-80	95845	67067	111876	2549	2928	15577	3520	112.3	14.32	143
1980-81	105494	68181	116705	2802	3403	16313	3653	112.7	14.93	148
1981-82	113733	66450	121811	3068	3589	17498	3896	114.8	15.06	152
1982-83	107711	71584	131237	3502	4319	17801	4032	112.9	15.87	154
1983-84	119509	81239	137424	3856	4526	20421	4308	115.3	16.16	158
1984-85	114953	76869	144813	4408	5702	22160	4689	113.4	16.77	161

Years	GDPA (Imillion)	GDPI (million)	GDPS (million)	DC (MU)	AC (MU)	IC (MU)	SC (MU)	CI	ratio	POP (millions)
1985-86	110069	86962	157351	4984	6161	24144	4898	113.5	17.44	165
1986-87	100013	93072	165434	5780	7301	25399	5382	113.5	17.61	169
1987-88	103636	94651	174369	6826	9443	25841	5955	115.1	18.11	173
1988-89	132320	108554	191528	7568	11005	27751	6343	113.8	17.59	176
1989-90	138879	120476	210199	8743	12354	27500	6792	119.6	18.04	179
1990-91	141212	133029	223475	9447	14808	30077	7201	119.5	20.17	184
1991-92	118363	119648	241548	10388	18789	31477	7750	116.0	21.82	188
1992-93	152810	147116	262073	11376	19631	30898	8275	118.5	22.38	191
1993-94	149842	156252	288767	11954	23267	33933	9273	120.1	23.90	195
1994-95	159372	180433	307966	12916	27152	35697	9570	119.7	24.86	199
1995-96	154293	203033	328370	14520	32043	37825	10466	119.2	26.18	202
1996-97	159472	212963	347546						30.54	206
1997-98	164811	223359	367810						31.24	209
1998-99	170315	234242	389222						31.95	212
1999-00	175987	245635	411846						32.65	215
2000-01	181833	257560	435749						33.36	218
2001-02	187857	270042	461000						34.07	223
2002-03	194065	283105	487674						34.77	226
2003-04	200461	296775	515849						35.48	229
2004-05	207051	311081	545608						36.18	232
2005-06	213841	326049	577036						36.89	235
2006-07	220836	341711	610226						37.60	239
2007-08	228041	358096	645274						38.30	242
2008-09	235463	375238	682281						39.01	245
2009-10	243108	393169	721354						39.71	248
2010-11	250981	411925	762606						40.42	251
2011-12	259090	431544	806155						41.13	254
2012-13	267440	452062	852126						41.83	257
2013-14	276038	473520	900651						42.54	260
2014-15	284892	495959	951869						43.24	263
2015-16	294008	519424	1005924						43.95	266
2016-17	303393	543958	1062972						44.66	269
2017-18	313056	569611	1123173						45.36	272
2018-19	323003	596430	1186699						46.07	275
2019-20	333242	624468	1253729						46.77	277
2020-21	343781	653778	1324451						47.48	280

Table 16 Input data for power demand forecast (East _high)

Years	GDPA (millions)	GDPI (millions)	GDPS(millions)	DC(MU)	AC(MU)	IC (MU)	SC (MU)	CI	POP (millions)
1970-71	64586	29787	52360	777	101	6653	1405		122
1971-72	64932	29773	54287	778	81	6970	1504		124
1972-73	63457	30286	56602	812	118	7097	1572		126
1973-74	64691	31491	57262	862	112	6884	1452		129
1974-75	64599	31395	57855	924	124	7035	1525		132
1975-76	71392	37453	62155	950	515	8126	1773		135
1976-77	67410	35943	67801	874	532	8651	2042		137
1977-78	76807	36807	70682	919	386	8840	2071	131.8	140
1978-79	76236	37116	71885	991	308	9200	2015	136.4	143
1979-80	64592	36771	74067	1002	566	8172	2034	136.9	146
1980-81	81054	35092	77713	1005	566	8384	1958	137.4	150
1981-82	76336	37282	81150	1111	624	9591	2178	136.8	153
1982-83	73287	38409	85320	1222	785	9347	2341	125.1	156
1983-84	91280	40624	89724	1314	821	10045	2450	146.3	159
1984-85	93590	42444	93592	1533	788	10488	2551	138.3	163
1985-86	98598	42920	98790	1766	994	10701	2753	141.8	166
1986-87	102632	44033	105405	1984	1282	11068	3018	145.2	170
1987-88	95076	47470	109739	2402	1572	11553	3285	148.0	173
1988-89	106557	54251	116135	2501	1743	11547	3724	145.6	177
1989-90	107400	54701	121241	2771	1805	11016	3787	145.1	181
1990-91	104711	53827	132020	3140	2100	11547	4091	148.7	185
1991-92	106781	56625	138198	3586	2567	12439	3757	147.6	188
1992-93	101789	53654	144230	2080	2567	12461	3947	145.2	192
1993-94	110555	54388	151700	4742	2526	14748	4353	148.0	196
1994-95	120514	55368	162691	5859	2846	14146	4917	149.0	200
1995-96	117154	59836	171550	6553	3021	15658	5096	150.9	203
1996-97	122804	64008	185792						207
1997-98	128727	68471	201216						209
1998-99	134936	73245	217921						212
1999-00	141444	78351	236013						214
2000-01	148265	83814	255607						216
2001-02	155416	89657	276827						219
2002-03	162912	95908	299810						222
2003-04	170769	102595	324700						225
2004-05	179006	109748	351656						228
2005-06	187639	117399	380851						231
2006-07	196689	125584	412469						234
2007-08	206175	134340	446712						238
2008-09	216119	143706	483798						241
2009-10	226542	153726	523963						244
2010-11	237468	164443	567463						247
2011-12	248922	175908	614574						250
2012-13	260927	188173	665595						253
2013-14	273512	201292	720853						256

Years	GDPA (millions)	GDPI (millions)	GDPS(millions)	DC(MU)	AC(MU)	IC (MU)	SC (MU)	CI	POP (millions)
2014-15	286703	215326	780698						259
2015-16	300531	230339	845512						263
2016-17	315025	246398	915706						265
2017-18	330219	263577	991728						268
2018-19	346145	281953	1074062						270
2019-20	362840	301611	1163230						273
2020-21	380340	322640	1259802						276

Table 17 Input data for power demand forecast (East _medium)

Years	GDPA (millions)	GDPI (millions)	GDPS (millions)	DC(MU)	AC(MU)	IC(MU)	SC(MU)	CI	POP (millions)
1970-71	64586	29787	52360	777	101	6653	1405		122
1971-72	64932	29773	54287	778	81	6970	1504		124
1972-73	63457	30286	56602	812	118	7097	1572		126
1973-74	64691	31491	57262	862	112	6884	1452		129
1974-75	64599	31395	57855	924	124	7035	1525		132
1975-76	71392	37453	62155	950	515	8126	1773		135
1976-77	67410	35943	67801	874	532	8651	2042		137
1977-78	76807	36807	70682	919	386	8840	2071	131.8	140
1978-79	76236	37116	71885	991	308	9200	2015	136.4	143
1979-80	64592	36771	74067	1002	566	8172	2034	136.9	146
1980-81	81054	35092	77713	1005	566	8384	1958	137.4	150
1981-82	76336	37282	81150	1111	624	9591	2178	136.8	153
1982-83	73287	38409	85320	1222	785	9347	2341	125.1	156
1983-84	91280	40624	89724	1314	821	10045	2450	146.3	159
1984-85	93590	42444	93592	1533	788	10488	2551	138.3	163
1985-86	98598	42920	98790	1766	994	10701	2753	141.8	166
1986-87	102632	44033	105405	1984	1282	11068	3018	145.2	170
1987-88	95076	47470	109739	2402	1572	11553	3285	148.0	173
1988-89	106557	54251	116135	2501	1743	11547	3724	145.6	177
1989-90	107400	54701	121241	2771	1805	11016	3787	145.1	181
1990-91	104711	53827	132020	3140	2100	11547	4091	148.7	185
1991-92	106781	56625	138198	3586	2567	12439	3757	147.6	188
1992-93	101789	53654	144230	2080	2567	12461	3947	145.2	192
1993-94	110555	54388	151700	4742	2526	14748	4353	148.0	196
1994-95	120514	55368	162691	5859	2846	14146	4917	149.0	200
1995-96	117154	59836	171550	6553	3021	15658	5096	150.9	203
1996-97	121997	63412	183757						207
1997-98	127041	67202	196833						209
1998-99	132292	71218	210840						212
1999-00	137761	75474	225844						214
2000-01	143456	79984	241915						216
2001-02	149387	84764	259129						219
2002-03	155563	89829	277569						222
2003-04	161993	95197	297321						225
2004-05	168690	100886	318478						228

Years	GDPA (millions)	GDPI (millions)	GDPS (millions)	DC(MU)	AC(MU)	IC(MU)	SC(MU)	CI	POP (millions)
2005-06	175664	106915	341141						231
2006-07	182926	113305	365416						234
2007-08	190488	120076	391419						238
2008-09	198363	127251	419273						241
2009-10	206563	134856	449108						244
2010-11	215102	142915	481067						247
2011-12	223995	151456	515300						250
2012-13	233255	160507	551968						253
2013-14	242897	170098	591246						256
2014-15	252939	180263	633319						259
2015-16	263395	191036	678386						263
2016-17	274284	202452	726660						265
2017-18	285623	214551	778370						268
2018-19	297431	227372	833758						270
2019-20	309726	240960	893089						273
2020-21	322531	255360	956641						276

Table1 8 Input data for power demand forecast (East_low)

Years	GDPA(millions)	GDPI(millions)	GDPS(millions)	DC(MU)	AC(MU)	IC(MU)	SC(MU)	CI	POP(millions)
1970-71	64586	29787	52360	777	101	6653	1405		122
1971-72	64932	29773	54287	778	81	6970	1504		124
1972-73	63457	30286	56602	812	118	7097	1572		126
1973-74	64691	31491	57262	862	112	6884	1452		129
1974-75	64599	31395	57855	924	124	7035	1525		132
1975-76	71392	37453	62155	950	515	8126	1773		135
1976-77	67410	35943	67801	874	532	8651	2042		137
1977-78	76807	36807	70682	919	386	8840	2071	131.8	140
1978-79	76236	37116	71885	991	308	9200	2015	136.4	143
1979-80	64592	36771	74067	1002	566	8172	2034	136.9	146
1980-81	81054	35092	77713	1005	566	8384	1958	137.4	150
1981-82	76336	37282	81150	1111	624	9591	2178	136.8	153
1982-83	73287	38409	85320	1222	785	9347	2341	125.1	156
1983-84	91280	40624	89724	1314	821	10045	2450	146.3	159
1984-85	93590	42444	93592	1533	788	10488	2551	138.3	163
1985-86	98598	42920	98790	1766	994	10701	2753	141.8	166
1986-87	102632	44033	105405	1984	1282	11068	3018	145.2	170
1987-88	95076	47470	109739	2402	1572	11553	3285	148.0	173
1988-89	106557	54251	116135	2501	1743	11547	3724	145.6	177
1989-90	107400	54701	121241	2771	1805	11016	3787	145.1	181
1990-91	104711	53827	132020	3140	2100	11547	4091	148.7	185
1991-92	106781	56625	138198	3586	2567	12439	3757	147.6	188
1992-93	101789	53654	144230	2080	2567	12461	3947	145.2	192
1993-94	110555	54388	151700	4742	2526	14748	4353	148.0	196
1994-95	120514	55368	162691	5859	2846	14146	4917	149.0	200
1995-96	117154	59836	171550	6553	3021	15658	5096	150.9	203

Years	GDPA(millions)	GDPI(millions)	GDPS(millions)	DC(MU)	AC(MU)	IC(MU)	SC(MU)	CI	POP(millions)
1996-97	121190	62816	181723						207
1997-98	125365	65944	192499						209
1998-99	129684	69228	203914						212
1999-00	134151	72676	216006						214
2000-01	138773	76295	228815						216
2001-02	143554	80095	242384						219
2002-03	148499	84083	256757						222
2003-04	153615	88271	271983						225
2004-05	158907	92667	288112						228
2005-06	164381	97282	305197						231
2006-07	170044	102126	323295						234
2007-08	175902	107212	342466						238
2008-09	181962	112551	362775						241
2009-10	188231	118156	384287						244
2010-11	194715	124040	407075						247
2011-12	201423	130218	431215						250
2012-13	208362	136702	456786						253
2013-14	215540	143510	483873						256
2014-15	222966	150657	512567						259
2015-16	230647	158160	542962						263
2016-17	238592	166036	575160						265
2017-18	246812	174305	609267						268
2018-19	255315	182985	645396						270
2019-20	264110	192098	683668						273
2020-21	273209	201664	724210						276

Table 19 Input data for power demand forecast (North east _high)

Years	GDPA (millions)	GDPI (millions)	GDPS (million)	DC (MU)	AC (MU)	IC (MU)	SC (MU)	CI	POP (millions)
1970-71	8784	1350	7347	39	1	164	91		14
1971-72	9177	1410	7706	45	1	208	84		15
1972-73	9479	1453	7796	50	2	235	94		15
1973-74	10108	1510	7861	44	2	184	149		16
1974-75	9846	1576	8011	51	5	193	176		16
1975-76	10951	1646	8327	45	5	219	329		17
1976-77	10476	1702	9003	48	2	286	357		17
1977-78	10868	1207	10629	53	4	403	307	125	18
1978-79	10752	1299	11542	55	5	424	314	125	18
1979-80	10565	1107	10900	58	3	433	413	128	19
1980-81	14312	1717	13390	67	4	406	447	130	18
1981-82	14245	3316	14610	92	10	511	478	128	18
1982-83	15218	3380	15086	88	9	469	556	131	19
1983-84	15761	3440	15793	95	9	525	554	131	19
1984-85	15228	3603	16583	114	9	538	564	135	19
1985-86	16165	3658	17702	116	7	587	584	135	20
1986-87	15562	3635	17734	139	22	583	600	135	20

Years	GDPA (millions)	GDPI (millions)	GDPS (milllion)	DC (MU)	AC (MU)	IC (MU)	SC (MU)	CI	POP (millions)
1987-88	16669	3778	18578	137	13	696	692	135	21
1988-89	16432	3867	19583	150	13	800	650	135	21
1989-90	17695	4097	21027	181	26	856	692	138	22
1990-91	18033	4091	22812	192	26	879	680	140	22
1991-92	18455	4235	24392	243	36	806	876	143	23
1992-93	18285	4113	25192	410	64	945	783	142	23
1993-94	18850	4136	26892	588	77	942	855	142	24
1994-95	19097	4060	28185	589	89	931	779	140	24
1995-96	19614	4161	30139	693	96	921	965	138	25
1996-97	20560	4451	32641						25
1997-98	21552	4761	35351						25
1998-99	22591	5093	38285						25
1999-00	23681	5448	41464						26
2000-01	24823	5828	44906						26
2001-02	26020	6234	48634						27
2002-03	27275	6669	52672						27
2003-04	28591	7134	57045						27
2004-05	29970	7631	61780						28
2005-06	31415	8163	66910						28
2006-07	32930	8732	72464						29
2007-08	34518	9341	78480						29
2008-09	36183	9992	84996						29
2009-10	37928	10689	92052						30
2010-11	39758	11434	99694						30
2011-12	41675	12231	107971						31
2012-13	43685	13084	116935						31
2013-14	45792	13996	126643						31
2014-15	48000	14972	137156						32
2015-16	50316	16016	148543						32
2016-17	52742	17133	160875						33
2017-18	55286	18327	174231						33
2018-19	57952	19605	188696						33
2019-20	60748	20972	204361						33
2020-21	63677	22434	221327						34

Table 20 Input data for power demand forecast (North east_ medium)

Years	GDPA (million)	GDPI (millions)	GDPS(millions)	DC(MU)	AC(MU)	IC(MU)	SC(MU)	CI	POP (millions)
1970-71	8784	1350	7347	39	1	164	91		14
1971-72	9177	1410	7706	45	1	208	84		15
1972-73	9479	1453	7796	50	2	235	94		15
1973-74	10108	1510	7861	44	2	184	149		16
1974-75	9846	1576	8011	51	5	193	176		16
1975-76	10951	1646	8327	45	5	219	329		17
1976-77	10476	1702	9003	48	2	286	357		17
1977-78	10868	1207	10629	53	4	403	307	125	18
1978-79	10752	1299	11542	55	5	424	314	125	18
1979-80	10565	1107	10900	58	3	433	413	128	19
1980-81	14312	1717	13390	67	4	406	447	130	18
1981-82	14245	3316	14610	92	10	511	478	128	18
1982-83	15218	3380	15086	88	9	469	556	131	19
1983-84	15761	3440	15793	95	9	525	554	131	19
1984-85	15228	3603	16583	114	9	538	564	135	19
1985-86	16165	3658	17702	116	7	587	584	135	20
1986-87	15562	3635	17734	139	22	583	600	135	20
1987-88	16669	3778	18578	137	13	696	692	135	21
1988-89	16432	3867	19583	150	13	800	650	135	21
1989-90	17695	4097	21027	181	26	856	692	138	22
1990-91	18033	4091	22812	192	26	879	680	140	22
1991-92	18455	4235	24392	243	36	806	876	143	23
1992-93	18285	4113	25192	410	64	945	783	142	23
1993-94	18850	4136	26892	588	77	942	855	142	24
1994-95	19097	4060	28185	589	89	931	779	140	24
1995-96	19614	4161	30139	693	96	921	965	138	25
1996-97	20425	4409	32283						25
1997-98	21269	4673	34581						25
1998-99	22149	4952	37041						25
1999-00	23064	5248	39677						26
2000-01	24018	5562	42501						26
2001-02	25011	5894	45525						27
2002-03	26045	6246	48764						27
2003-04	27121	6619	52235						27
2004-05	28243	7015	55952						28
2005-06	29410	7434	59933						28
2006-07	30626	7878	64198						29
2007-08	31892	8349	68766						29
2008-09	33210	8848	73660						29
2009-10	34583	9377	78901						30
2010-11	36013	9937	84516						30
2011-12	37502	10531	90530						31
2012-13	39052	11161	96972						31
2013-14	40666	11827	103873						31

Years	GDPA (million)	GDPI (millions)	GDPS(millions)	DC(MU)	AC(MU)	IC(MU)	SC(MU)	CI	POP (millions)
2014-15	42348	12534	111264						32
2015-16	44098	13283	119182						32
2016-17	45921	14077	127663						33
2017-18	47820	14918	136747						33
2018-19	49797	15810	146478						33
2019-20	51855	16755	156902						33
2020-21	53999	17756	168067						34

Table 21 Input data for power demand forecast (North East _low)

Years	GDPA (million)	GDPI (million	GDPS (million)	DC (MU)	AC (MU)	IC (MU)	SC (MU)	CI	POP (millions)
1970-71	8784	1350	7347	39	1	164	91		14
1971-72	9177	1410	7706	45	1	208	84		15
1972-73	9479	1453	7796	50	2	235	94		15
1973-74	10108	1510	7861	44	2	184	149		16
1974-75	9846	1576	8011	51	5	193	176		16
1975-76	10951	1646	8327	45	5	219	329		17
1976-77	10476	1702	9003	48	2	286	357		17
1977-78	10868	1207	10629	53	4	403	307	125	18
1978-79	10752	1299	11542	55	5	424	314	125	18
1979-80	10565	1107	10900	58	3	433	413	128	19
1980-81	14312	1717	13390	67	4	406	447	130	18
1981-82	14245	3316	14610	92	10	511	478	128	18
1982-83	15218	3380	15086	88	9	469	556	131	19
1983-84	15761	3440	15793	95	9	525	554	131	19
1984-85	15228	3603	16583	114	9	538	564	135	19
1985-86	16165	3658	17702	116	7	587	584	135	20
1986-87	15562	3635	17734	139	22	583	600	135	20
1987-88	16669	3778	18578	137	13	696	692	135	21
1988-89	16432	3867	19583	150	13	800	650	135	21
1989-90	17695	4097	21027	181	26	856	692	138	22
1990-91	18033	4091	22812	192	26	879	680	140	22
1991-92	18455	4235	24392	243	36	806	876	143	23
1992-93	18285	4113	25192	410	64	945	783	142	23
1993-94	18850	4136	26892	588	77	942	855	142	24
1994-95	19097	4060	28185	589	89	931	779	140	24
1995-96	19614	4161	30139	693	96	921	965	138	25
1996-97	20290	4368	31926						25
1997-98	20989	4585	33819						25
1998-99	21712	4814	35824						25
1999-00	22460	5053	37949						26
2000-01	23234	5305	40199						26
2001-02	24034	5569	42583						27
2002-03	24862	5847	45108						27
2003-04	25719	6138	47783						27
2004-05	26605	6443	50617						28

Years	GDPA (million)	GDPI (million	GDPS (million)	DC (MU)	AC (MU)	IC (MU)	SC (MU)	CI	POP (millions)
2005-06	27521	6764	53618						28
2006-07	28469	7101	56798						29
2007-08	29450	7455	60166						29
2008-09	30465	7826	63734						29
2009-10	31514	8216	67513						30
2010-11	32600	8625	71517						30
2011-12	33723	9054	75758						31
2012-13	34884	9505	80250						31
2013-14	36086	9979	85009						31
2014-15	37329	10476	90050						32
2015-16	38615	10997	95390						32
2016-17	39946	11545	101047						33
2017-18	41322	12120	107039						33
2018-19	42745	12724	113386						33
2019-20	44218	13357	120110						33
2020-21	45741	14022	127232						34

Annexure 2.2 Captive power

High growth scenario (7% GDP growth rate)

Table 1 Coal for captive power generation

Years	Captive power (BU)	Steam based captive (BU)	Coal (MT)
1999/2000	54.14	34.67	24.62
2000/01	60.28	37.23	26.43
2001/02	66.26	39.48	28.03
2002/03	72.86	41.87	29.73
2003/04	80.14	44.42	31.54
2004/05	88.17	47.14	33.47
2005/06	97.05	50.04	35.53
2006/07	106.86	53.15	37.73
2011/12	174.23	72.34	51.36
2016/17	288.92	100.14	71.10
2020/21	435.51	130.65	92.76

Medium growth scenario (6% pa GDP growth)

Table 2 Coal for captive power generation

Years	Captive power (BU)	Steam based captive (BU)	Coal (MT)
1999/2000	53.21	34.78	24.20
2000/01	58.15	35.42	25.50
2001/02	63.55	37.86	26.88
2002/03	69.46	39.94	28.34
2003/04	75.95	42.39	29.89
2004/05	83.06	44.41	31.53
2005/06	90.86	46.85	33.27
2006/07	99.43	49.45	35.11
2011/12	156.94	65.6	46.29
2016/17	251.48	87.09	61.84
2020/21	371.77	111.53	79.19

Low growth scenario (5% pa GDP growth)

Table 3 Coal for captive power generation

Years	Captive power (BU)	Steam based captive (BU)	Coal (MT)
1999/2000	52.00	33.30	23.64
2000/01	56.90	35.15	24.95
2001/02	61.70	36.76	26.10
2002/03	66.91	38.45	27.30
2003/04	72.58	40.23	28.56
2004/05	78.75	42.10	29.89
2005/06	85.46	44.07	31.29
2006/07	92.76	46.14	32.76
2011/12	140.59	58.37	41.44
2016/17	215.92	74.84	53.14
2020/21	306.26	91.88	65.23

High growth rate

Table 4 Input data for captive power generation

	North (MU)	South (MU)	East (MU)	West (MU)	Neast (MU)	total ind gnd cons (MU)	Captive (MU)	Total industrial cons (MU)	share of captive	steam based captive	share of steam
1980-81	9582	13062	8384	16313	406	47747	8773	56520	0.155	7207	0.821
1981-82	11329	14912	9591	17498	511	53841	8979	62820	0.143	7737	0.862
1982-83	10654	14142	9347	17801	469	52413	9989	62402	0.160	8497	0.851
1983-84	11742	14663	10045	20421	525	57396	10769	68165	0.158	8927	0.829
1984-85	11824	17948	10488	22160	538	62958	12303	75261	0.163	9966	0.810
1985-86	13528	17387	10701	24144	587	66347	12997	79344	0.164	10226	0.787
1986-87	14633	18001	11068	25399	583	69684	13528	83212	0.163	10910	0.806
1987-88	14510	16534	11553	25841	696	69134	16855	85989	0.196	13737	0.815
1988-89	16761	19249	11547	27751	800	76108	19880	95988	0.207	16314	0.821
1989-90	18432	21652	11016	27500	856	79456	23197	102653	0.226	19110	0.824
1990-91	19295	22693	12794	29050	747.9	84580	25081	109661	0.229	20005	0.798
1991-92	19400	22577	13468	29798	773	86016	28581	114597	0.249	23409	0.819
1992-93	19909	23188	12752	31901	751.7	88502	31327	119829	0.261	24680	0.788
1993-94	20555	24857	12929	33436	755.7	92532	32262	124794	0.259	25407	0.788
1994-95	21720	26115	13165	35428	742.4	97170	35043	132213	0.265	27388	0.782
1995-96	23198	27714	14241	37374	760	103288	38142	141430	0.270	28751	0.754
1996-97	24569	29843	15246	39115	810.9	109584	40814	150398	0.271	29128	0.714
1997-98	26016	32129	16321	40906	865.1	116236	44839	161075	0.278	30865	0.688
1998-99	27543	34582	17471	42746	923	123264	49266	172531	0.286	32710	0.664
1999-00	29154	37214	18701	44638	984.7	130691	54140	184830	0.293	34671	0.640
2000-01	*30854*	*40037*	*20016*	*46579*	*1051*	*140331*	*60277*	*200608*	0.300	37232	0.618
2001-02	32648	43066	21424	48571	1121	148721	66262	214983	0.308	39478	0.596
2002-03	34540	46314	22929	50614	1196	157587	72860	230447	0.316	41869	0.575
2003-04	36535	49796	24540	52707	1276	166956	80138	247094	0.324	44418	0.554
2004-05	38638	53528	26263	54850	1361	176858	88172	265030	0.333	47138	0.535
2005-06	40856	57529	28106	57044	1452	187324	97046	284370	0.341	50042	0.516
2006-07	43193	61816	30077	59288	1549	198388	106856	305243	0.350	53146	0.497
2207-08	45657	66409	32186	61582	1653	210083	117709	327792	0.359	56468	0.480
2008-09	48253	71329	34442	63927	1764	222449	129726	352176	0.368	60026	0.463
2009-10	50988	76598	36855	66321	1882	235526	143046	378571	0.378	63842	0.446
2010-11	53870	82241	39436	68764	2008	249354	157822	407176	0.388	67938	0.430
2011-12	56905	88283	42198	71257	2142	263981	174233	438213	0.398	72342	0.415
2012-13	60101	94750	45152	73799	2285	279453	192478	471931	0.408	77084	0.400
2013-14	63467	101673	48312	76390	2438	295823	212787	508610	0.418	82195	0.386
2014-15	67010	109081	51692	79029	2601	313144	235423	548567	0.429	87713	0.373
2015-16	70741	117008	55308	81716	2775	331474	260685	592159	0.440	93681	0.359
2016-17	74667	125488	59176	84451	2961	350876	288920	639796	0.452	100145	0.347
2017-18	78800	134560	63313	87234	3159	371414	320526	691940	0.463	107160	0.334
2018-19	83149	144262	67739	90063	3370	393159	355964	749123	0.475	114787	0.322
2019-20	87724	154637	72474	92939	3596	416185	395771	811955	0.487	123097	0.311
2020-21	92538	165731	77539	95862	3836	435506	435506	871012	0.500	130652	0.300

Medium growth rate

Table 5 Input data for captive power generation

	North (MU)	South (MU)	East (MU)	West (MU)	Neast (MU)	total industrial grid consp. (MU)	Captive (MU)	Total ind. (MU)	share of captive	steam based captive (MU)	share of steam
1980-81	9582	13062	8384	16313	406	47747	8773	56520	0.155	7207	0.821
1981-82	11329	14912	9591	17498	511	53841	8979	62820	0.143	7737	0.862
1982-83	10654	14142	9347	17801	469	52413	9989	62402	0.160	8497	0.851
1983-84	11742	14663	10045	20421	525	57396	10769	68165	0.158	8927	0.829
1984-85	11824	17948	10488	22160	538	62958	12303	75261	0.163	9966	0.810
1985-86	13528	17387	10701	24144	587	66347	12997	79344	0.164	10226	0.787
1986-87	14633	18001	11068	25399	583	69684	13528	83212	0.163	10910	0.806
1987-88	14510	16534	11553	25841	696	69134	16855	85989	0.196	13737	0.815
1988-89	16761	19249	11547	27751	800	76108	19880	95988	0.207	16314	0.821
1989-90	18432	21652	11016	27500	856	79456	23197	102653	0.226	19110	0.824
1990-91	19295	22693	12794	28963	748	84493	25081	109574	0.229	20005	0.798
1991-92	19400	22577	13468	30369	773	86586	28581	115167	0.248	23409	0.819
1992-93	19909	23188	12752	32002	752	88603	31327	119930	0.261	24680	0.788
1993-94	20555	24857	12929	33610	756	92707	32262	124969	0.258	25407	0.788
1994-95	21720	26115	13165	35329	742	97071	35043	132114	0.265	27388	0.782
1995-96	23198	27714	14241	37092	760	103006	38142	141148	0.270	28751	0.754
1996-97	24374	29538	15102	38875	804	108693	40814	149507	0.273	29128	0.714
1997-98	25606	31477	16015	40716	850	114664	44583	159248	0.280	30689	0.688
1998-99	26896	33538	16982	42618	898	120933	48705	169637	0.287	32337	0.664
1999-00	28248	35727	18008	44579	950	127512	53213	180725	0.294	34078	0.640
2000-01	29664	38054	19094	46601	1004	135899	58788	194687	0.302	36313	0.618
2001-02	31146	40525	20245	48685	1062	143216	64244	207460	0.310	38276	0.596
2002-03	32699	43150	21465	50831	1123	150892	70221	221113	0.318	40353	0.575
2003-04	34324	45937	22758	53039	1187	158947	76770	235717	0.326	42552	0.554
2004-05	36025	48897	24128	55311	1255	167397	83952	251349	0.334	44882	0.535
2005-06	37806	52039	25580	57646	1327	176261	91831	268093	0.343	47353	0.516
2006-07	39669	55374	27119	60044	1404	185561	100482	286042	0.351	49976	0.497
2207-08	41619	58915	28750	62507	1484	195316	109986	305301	0.360	52763	0.480
2008-09	43660	62672	30479	65035	1569	205548	120435	325984	0.369	55727	0.463
2009-10	45794	66658	32310	67627	1659	216282	131935	348217	0.379	58883	0.446
2010-11	48027	70888	34251	70285	1754	227541	144600	372140	0.389	62246	0.430
2011-12	50363	75375	36308	73007	1855	239351	158562	397912	0.398	65836	0.415
2012-13	52806	80134	38488	75795	1961	251738	173970	425708	0.409	69672	0.400
2013-14	55360	85182	40798	78647	2074	264733	190992	455725	0.419	73776	0.386
2014-15	58031	90535	43247	81566	2193	278363	209820	488184	0.430	78174	0.373
2015-16	60824	96210	45841	84550	2319	292662	230672	523334	0.441	82895	0.359
2016-17	63743	102227	48591	87598	2451	307663	253795	561458	0.452	87970	0.347
2017-18	66794	108606	51505	90713	2592	323400	279476	602876	0.464	93436	0.334
2018-19	69984	115367	54593	93892	2741	339910	308043	647954	0.475	99334	0.322
2019-20	73317	122532	57866	97136	2898	357233	339875	697108	0.488	105712	0.311
2020-21	76801	130126	61334	100445	3064	371769	371769	743539	0.500	111531	0.300

Low growth rate

Table 6 Inputs data for captive power generation

	North (MU)	South (MU)	east (MU)	West (MU)	Neast (MU)	total ind grid cons (MU)	Captive (MU)	Total ind cons	share of captive (%)	steam based captive (MU)	share of steam (%)
1980-81	9582	13062	8384	16313	406	47747	8773	56520	0.155	7207	0.821
1981-82	11329	14912	9591	17498	511	53841	8979	62820	0.143	7737	0.862
1982-83	10654	14142	9347	17801	469	52413	9989	62402	0.160	8497	0.851
1983-84	11742	14663	10045	20421	525	57396	10769	68165	0.158	8927	0.829
1984-85	11824	17948	10488	22160	538	62958	12303	75261	0.163	9966	0.810
1985-86	13528	17387	10701	24144	587	66347	12997	79344	0.164	10226	0.787
1986-87	14633	18001	11068	25399	583	69684	13528	83212	0.163	10910	0.806
1987-88	14510	16534	11553	25841	696	69134	16855	85989	0.196	13737	0.815
1988-89	16761	19249	11547	27751	800	76108	19880	95988	0.207	16314	0.821
1989-90	18432	21652	11016	27500	856	79456	23197	102653	0.226	19110	0.824
1990-91	19295	22693	12794	29050	748	84580	25081	109661	0.229	20005	0.798
1991-92	19400	22577	13468	29798	773	86016	28581	114597	0.249	23409	0.819
1992-93	19909	23188	12752	31901	752	88502	31327	119829	0.261	24680	0.788
1993-94	20555	24857	12929	33436	756	92532	32262	124794	0.259	25407	0.788
1994-95	21720	26115	13165	35428	742	97170	35043	132213	0.265	27388	0.782
1995-96	23198	27714	14241	37374	760	103288	38142	141430	0.270	28751	0.754
1996-97	24179	29234	14959	39014	796	108182	40814	148996	0.274	29128	0.714
1997-98	25199	30833	15712	40696	834	113274	44244	157517	0.281	30456	0.688
1998-99	26259	32515	16503	42419	874	118570	47964	166534	0.288	31846	0.664
1999-00	27361	34286	17334	44183	916	124079	52001	176080	0.295	33302	0.640
2000-01	28507	36148	18205	45988	960	130998	56900	187899	0.303	35147	0.618
2001-02	29697	38108	19121	47833	1006	137002	61699	198702	0.311	36760	0.596
2002-03	30935	40169	20081	49720	1054	143245	66914	210158	0.318	38452	0.575
2003-04	32221	42336	21090	51646	1104	149734	72582	222316	0.326	40230	0.554
2004-05	33558	44616	22148	53612	1157	156481	78747	235228	0.335	42099	0.535
2005-06	34947	47013	23260	55618	1212	163493	85457	248951	0.343	44066	0.516
2006-07	36390	49533	24427	57663	1270	170783	92765	263547	0.352	46138	0.497
2207-08	37889	52183	25652	59747	1331	178359	100729	279088	0.361	48322	0.480
2008-09	39446	54968	26938	61869	1395	186233	109415	295649	0.370	50628	0.463
2009-10	41064	57896	28288	64029	1461	194418	118897	313315	0.379	53064	0.446
2010-11	42744	60973	29705	66226	1531	202924	129257	332181	0.389	55642	0.430
2011-12	44489	64206	31193	68460	1604	211765	140587	352352	0.399	58373	0.415
2012-13	46301	67604	32755	70730	1681	220953	152990	373944	0.409	61270	0.400
2013-14	48183	71175	34395	73037	1761	230503	166584	397087	0.420	64348	0.386
2014-15	50136	74926	36116	75378	1846	240430	181500	421930	0.430	67623	0.373
2015-16	52164	78867	37923	77754	1934	250748	197888	448636	0.441	71114	0.359
2016-17	54270	83006	39820	80165	2026	261473	215918	477391	0.452	74841	0.347
2017-18	56456	87355	41812	82608	2123	272622	235784	508406	0.464	78828	0.334
2018-19	58725	91921	43902	85085	2225	284213	257708	541921	0.476	83102	0.322
2019-20	61079	96717	46097	87594	2331	296263	281946	578209	0.488	87694	0.311
2020-21	63523	101753	48401	90135	2442	306255	306255	612511	0.500	91877	0.300

Annexure 2.3 Iron and Steel

High growth scenario (7% rate of growth of GDP)

Table 1 Demand for hot metal and coal (million tonnes)

	Hot Metal	Dom Coal	Imported coal	
			CaseI	CaseII
1999/2000	20.56	13.83	11.39	11.39
2000/01	21.64	13.83	12.33	12.26
2001/02	22.78	13.83	13.32	13.17
2002/03	23.97	13.83	14.35	14.12
2003/04	25.21	13.83	15.44	15.12
2004/05	26.53	13.83	16.58	16.16
2005/06	27.91	13.83	17 78	17.25
2006/07	29.35	13.83	19.04	18.39
2011/12	37.80	13.83	26.39	24.98
2016/17	48.68	13.83	35.85	33.30
2020/21	59.59	13.83	45.34	41.17

Medium growth scenario (6% rate of growth of GDP)

Table 2 Demand for hot metal and coal (million tonnes)

	Hot Metal	Dom Coal	Imported coal	
			CaseI	CaseII
1999/2000	20.13	13.83	11.02	11.02
2000/01	21.04	13.83	11.81	11.74
2001/02	21.99	13.83	12.63	12.49
2002/03	22.98	13.83	13.49	13.27
2003/04	24.01	13.83	14.39	14.08
2004/05	25.08	13.83	15.32	14.92
2005/06	26.20	13.83	16.29	15.80
2006/07	27.37	13.83	17.31	16.71
2011/12	34.03	13.83	23.10	21.84
2016/17	42.30	13.83	30.30	28.09
2020/21	50.35	13.83	37.31	33.78

Low growth scenario (5% rate of growth of GDP)

Table 3 Demand for hot metal and coal (million tonnes)

	Hot Metal	Dom coal	Imported coal	
			CaseI	CaseII
1999/2000	19.71	13.83	10.65	10.65
2000/01	20.46	13.83	11.30	11.23
2001/02	21.23	13.83	11.97	11.83
2002/03	22.02	13.83	12.66	12.45
2003/04	22.84	13.83	13.37	13.09
2004/05	23.70	13.83	14.12	13.74
2005/06	24.58	13.83	14.88	14.42
2006/07	25.49	13.83	15.68	15.12
2011/12	30.60	13.83	20.12	18.98
2016/17	36.72	13.83	25.44	23.52
2020/21	42.48	13.83	30.46	27.49

Table 4 Input data for hotmetal demand forecast

YEAR	GDP_med (millions)	GDP_low (millions)	GDP_high (millions)
1970-71	904260	904260	904260
1971-72	913390	913390	913390
1972-73	910480	910480	910480
1973-74	951910	951910	951910
1974-75	962970	962970	962970
1975-76	1049680	1049680	1049680
1976-77	1062820	1062820	1062820
1977-78	1142190	1142190	1142190
1978-79	1205040	1205040	1205040
1979-80	1142360	1142360	1142360
1980-81	1224270	1224270	1224270
1981-82	1298890	1298890	1298890
1982-83	1339150	1339150	1339150
1983-84	1448650	1448650	1448650
1984-85	1504330	1504330	1504330
1985-86	1565660	1565660	1565660
1986-87	1632710	1632710	1632710
1987-88	1703220	1703220	1703220
1988-89	1884610	1884610	1884610
1989-90	2014530	2014530	2014530
1990-91	2122530	2122530	2122530
1991-92	2139830	2139830	2139830
1992-93	2252400	2252400	2252400
1993-94	2391450	2391450	2391450
1994-95	2577000	2577000	2577000
1995-96	2761320	2761320	2761320
1996-97	2968450	2968450	2968450

YEAR	GDP_med (millions)	GDP_low (millions)	GDP_high (millions)
1997-98	3146557	3116873	3176242
1998-99	3335350	3272716	3398578
1999-2000	3535471	3436352	3636479
2000-01	3747600	3608170	3891032
2001-02	3972456	3788578	4163405
2002-03	4210803	3978007	4454843
2003-04	4463451	4176907	4766682
2004-05	4731258	4385753	5100350
2005-06	5015134	4605040	5457374
2006-07	5316042	4835292	5839390
2007-08	5635004	5077057	6248148
2008-09	5973105	5330910	6685518
2009-10	6331491	5597455	7153504
2010-11	6711380	5877328	7654250
2011-12	7114063	6171194	8190047
2012-13	7540907	6479754	8763350
2013-14	7993361	6803742	9376785
2014-15	8472963	7143929	10033160
2015-16	8981341	7501125	10735481
2016-17	9520221	7876182	11486965
2017-18	10091435	8269991	12291052
2018-19	10696921	8683490	13151426
2019-20	11338736	9117665	14072026
2020-21	12019060	9573548	15057068

Annexure 2.4 Cement

High growth scenario (7% rate of growth GDP)

Table 1 Cement consumption with declining prices (PRFIT) (million tonnes)

Years	North	South	West	East	Neast	Total
1999/2000	21.29	24.30	26.17	10.58	0.66	83.00
2000/01	23.19	26.49	28.38	11.44	0.68	90.18
2001/02	25.26	28.87	30.86	12.36	0.71	98.05
2002/03	27.51	31.47	33.47	13.35	0.73	106.52
2003/04	29.96	34.30	36.28	14.41	0.76	115.72
2004/05	32.64	37.39	39.34	15.57	0.78	125.72
2005/06	35.55	40.75	42.66	16.81	0.81	136.58
2006/07	38.72	44.42	46.26	18.16	0.84	148.40
2011/12	59.35	68.33	69.20	26.72	1.01	224.61
2016/17	90.87	105.12	103.33	39.38	1.19	339.89
2020/21	127.90	148.38	142.52	53.82	1.36	473.97

Table 2 Coal requirement (PRFIT) (million tons)

Years	Case I	Case II	Case III		
			Domestic	Imported	Lignite
1999/2000	13.82	12.44	8.91	2.61	0.54
2000/01	14.93	13.44	9.44	2.96	0.62
2001/02	16.14	14.53	9.99	3.36	0.70
2002/03	17.45	15.70	10.55	3.82	0.80
2003/04	18.86	16.97	11.12	4.33	0.90
2004/05	20.10	18.09	11.55	4.85	1.01
2005/06	21.51	19.36	12.00	5.45	1.13
2006/07	23.08	20.78	12.49	6.14	1.28
2011/12	34.61	31.15	15.29	11.75	2.45
2016/17	52.37	47.13	16.51	22.69	4.73
2020/21	73.03	65.72	13.81	38.45	8.01

Table 3 Cement consumption with constant prices (PRCONS) (million tonnes)

Years	North	South	West	East	Neast	Total
1999/2000	21.13	24.04	26.00	10.73	0.66	82.55
2000/01	23.00	26.18	28.19	11.59	0.68	89.64
2001/02	25.04	28.51	30.64	12.51	0.71	97.40
2002/03	27.25	31.05	33.21	13.51	0.73	105.75
2003/04	29.67	33.82	35.99	14.58	0.76	114.82
2004/05	32.30	36.84	39.00	15.74	0.78	124.66
2005/06	35.16	40.13	42.27	16.98	0.81	135.35
2006/07	38.28	43.71	45.81	18.33	0.84	146.97
2011/12	58.52	67.00	68.37	26.88	1.01	221.78
2016/17	89.37	70.43	101.85	39.48	1.19	334.61
2020/21	125.53	144.59	140.23	53.81	1.36	465.52

Table 4 Coal requirement (PRCONS) (million tonnes)

Years	Case I	Case II	Case III		
			Domestic	Imported	Lignite
1999/2000	13.75	12.37	8.86	2.60	0.54
2000/01	14.84	13.36	9.38	2.95	0.61
2001/02	16.04	14.43	9.92	3.34	0.70
2002/03	17.32	15.59	10.47	3.79	0.79
2003/04	18.71	16.84	11.04	4.30	0.90
2004/05	19.93	17.94	11.45	4.81	1.00
2005/06	21.32	19.18	11.90	5.40	1.12
2006/07	22.86	20.58	12.37	6.08	1.27
2011/12	34.17	30.75	15.10	11.60	2.42
2016/17	51.55	46.40	16.25	22.33	4.65
2020/21	71.72	64.55	13.57	37.77	7.87

Table 5 Cement consumption with rising prices (PRGROW) (million tonnes)

Years	North	South	West	East	Neast	Total
1999/2000	21.11	23.97	25.97	10.73	0.66	82.43
2000/01	22.95	26.05	28.12	11.57	0.68	89.37
2001/02	24.95	28.32	30.52	12.48	0.71	96.96
2002/03	27.12	30.78	33.03	13.45	0.73	105.11
2003/04	29.48	33.46	35.75	14.50	0.76	113.94
2004/05	32.04	36.37	38.69	15.63	0.78	123.51
2005/06	34.83	39.53	41.87	16.85	0.81	133.89
2006/07	37.86	42.96	45.32	18.17	0.84	145.15
2011/12	57.42	65.16	67.15	26.46	1.01	217.20
2016/17	86.95	98.76	99.29	38.60	1.19	324.79
2020/21	121.29	137.72	135.84	52.30	1.36	448.51

Table 6 Coal requirement (PRGROW) (million tons)

Years	Case I	Case II	Case III		
			Domestic	Imported	Lignite
1999/2000	13.75	12.37	8.86	2.60	0.54
2000/01	14.84	13.36	9.38	2.95	0.61
2001/02	16.04	14.43	9.92	3.34	0.70
2002/03	17.32	15.59	10.47	3.79	0.79
2003/04	18.71	16.84	11.04	4.30	0.90
2004/05	19.93	17.94	11.45	4.81	1.00
2005/06	21.32	19.18	11.90	5.40	1.12
2006/07	22.86	20.58	12.37	6.08	1.27
2011/12	34.17	30.75	15.10	11.60	2.42
2016/17	51.55	46.40	16.25	22.33	4.65
2020/21	71.72	64.55	13.57	37.77	7.87

Medium growth scenario (6% rate of growth of GDP)

Table 7 Cement consumption with prices declining (PRFIT) (million tonnes)

Years	North	South	West	East	Neast	Total
1999/2000	20.45	23.70	24.74	10.49	0.65	80.03
2000/01	22.16	25.61	27.16	11.23	0.67	86.84
2001/02	24.02	27.68	29.88	12.01	0.70	94.30
2002/03	26.03	29.92	32.80	12.84	0.72	102.32
2003/04	28.21	32.34	35.99	13.73	0.75	111.02
2004/05	30.57	34.95	39.49	14.69	0.77	120.48
2005/06	33.13	37.78	43.34	15.71	0.80	130.75
2006/07	35.90	40.83	47.56	16.80	0.83	141.93
2011/12	53.66	60.23	75.55	23.51	0.98	213.94
2016/17	80.39	88.84	119.79	32.97	1.15	323.15
2020/21	110.83	121.25	173.35	43.30	1.31	450.04

Table 8 Coal requirement (PRFIT) (million tonnes)

Years	Case I	Case II	Case III		
			Domestic	Imported	Lignite
1999/2000	13.33	11.99	8.59	2.52	0.52
2000/01	14.38	12.94	9.09	2.85	0.59
2001/02	15.53	13.97	9.61	3.24	0.67
2002/03	16.76	15.08	10.13	3.67	0.76
2003/04	18.09	16.28	10.67	4.16	0.87
2004/05	19.26	17.34	11.06	4.65	0.97
2005/06	20.59	18.53	11.49	5.22	1.09
2006/07	22.08	19.87	11.94	5.87	1.22
2011/12	32.96	29.67	14.56	11.19	2.33
2016/17	49.79	44.81	15.69	21.57	4.49
2020/21	69.34	62.41	13.12	36.51	7.61

Table 9 Cement consumption with constant prices (PRCONS) (million tonnes)

Years	North	South	West	East	Neast	Total
1999/2000	20.33	23.46	24.58	10.43	0.65	79.46
2000/01	22.02	25.34	26.97	11.16	0.67	86.17
2001/02	23.86	27.37	29.67	11.93	0.70	93.52
2002/03	25.85	29.56	32.55	12.75	0.72	101.42
2003/04	28.00	31.92	35.69	13.63	0.75	109.99
2004/05	30.33	34.48	39.15	14.57	0.77	119.30
2005/06	32.85	37.24	42.94	15.57	0.80	129.40
2006/07	35.59	40.22	47.10	16.65	0.83	140.39
2011/12	53.08	59.12	74.65	23.26	0.98	211.09
2016/17	79.36	86.90	118.08	32.54	1.15	318.04
2020/21	109.25	118.28	170.56	42.67	1.31	442.06

Table 10 Coal requirement (PRCONS) (million tonnes)

Years	Case I	Case II	Case III		
			Domestic	Imported	Lignite
1999/2000	13.23	11.91	8.53	2.50	0.52
2000/01	14.27	12.84	9.02	2.83	0.59
2001/02	15.40	13.86	9.53	3.21	0.67
2002/03	16.61	14.95	10.04	3.63	0.76
2003/04	17.92	16.13	10.57	4.12	0.86
2004/05	19.08	17.17	10.96	4.60	0.96
2005/06	20.38	18.34	11.37	5.16	1.08
2006/07	21.84	19.65	11.81	5.81	1.21
2011/12	32.52	29.27	14.37	11.04	2.30
2016/17	49.00	44.10	15.44	21.23	4.42
2020/21	68.11	61.30	12.88	35.86	7.47

Table 11 Cement consumption with rising prices (PRGROW) (million tonnes)

Years	North	South	West	East	Neast	Total
1999/2000	20.32	23.37	24.55	10.42	0.65	79.31
2000/01	21.99	25.19	26.90	11.13	0.67	85.89
2001/02	23.79	27.15	29.55	11.89	0.70	93.08
2002/03	25.74	29.27	32.37	12.69	0.72	100.80
2003/04	27.86	31.54	35.46	13.55	0.75	109.15
2004/05	30.14	34.00	38.84	14.46	0.77	118.21
2005/06	32.61	36.65	42.54	15.44	0.80	128.04
2006/07	35.28	39.50	46.60	16.49	0.83	138.70
2011/12	52.31	57.43	73.32	22.88	0.98	206.92
2016/17	77.70	83.47	115.11	31.79	1.15	309.23
2020/21	106.39	112.54	165.23	41.44	1.31	426.90

Table 12 Coal requirement (PRGROW) (million tonnes)

Years	Case I	Case II	Case III		
			Domestic	Imported	Lignite
1999/2000	13.21	11.89	8.52	2.50	0.52
2000/01	14.22	12.80	8.99	2.82	0.59
2001/02	15.33	13.79	9.48	3.19	0.67
2002/03	16.51	14.86	9.98	3.61	0.75
2003/04	17.79	16.01	10.49	4.09	0.85
2004/05	18.90	17.01	10.86	4.56	0.95
2005/06	20.16	18.15	11.25	5.11	1.06
2006/07	21.58	19.42	11.67	5.74	1.20
2011/12	31.88	28.69	14.08	10.82	2.25
2016/17	47.64	42.88	15.02	20.64	4.30
2020/21	65.77	59.20	12.44	34.63	7.22

Low growth scenario

Table 13 Cement consumption with declining prices (PRFIT) (million tonnes)

Years	North	South	West	East	Neast	Total
1999/2000	20.01	23.10	23.05	10.39	0.65	77.20
2000/01	21.50	24.76	24.71	11.01	0.68	82.65
2001/02	23.11	26.53	26.55	11.66	0.70	88.56
2002/03	24.84	28.43	28.46	12.35	0.73	94.81
2003/04	26.69	30.47	30.50	13.08	0.75	101.50
2004/05	28.68	32.66	32.69	13.85	0.78	108.66
2005/06	30.83	35.00	35.03	14.67	0.81	116.33
2006/07	33.13	37.51	37.55	15.53	0.84	124.56
2011/12	47.49	53.03	53.00	20.70	1.00	175.22
2016/17	68.22	74.96	74.67	27.65	1.17	246.68
2020/21	90.97	98.90	98.31	34.91	1.33	324.42

Table 14 Coal requirement (PRFIT) (million tonnes)

Years	Case I	Case II	Case III		
			Domestic	Imported	Lignite
1999/2000	12.86	11.57	8.29	2.43	0.51
2000/01	13.68	12.32	8.65	2.72	0.57
2001/02	14.58	13.12	9.02	3.04	0.63
2002/03	15.53	13.98	9.39	3.40	0.71
2003/04	16.54	14.89	9.76	3.80	0.79
2004/05	17.38	15.64	9.98	4.19	0.87
2005/06	18.32	16.49	10.22	4.64	0.97
2006/07	19.38	17.44	10.48	5.15	1.07
2011/12	27.00	24.30	11.93	5.78	1.91
2016/17	38.01	34.21	11.98	16.46	3.43
2020/21	49.98	44.99	9.46	26.32	5.48

Table 15 Cement consumption with constant prices (PRCONS) (million tonnes)

Years	North	South	West	East	Neast	Total
1999/2000	19.82	22.85	22.90	10.32	0.65	77
2000/01	21.28	24.47	24.54	10.94	0.68	82
2001/02	22.86	26.20	26.36	11.58	0.70	88
2002/03	24.56	28.06	28.24	12.25	0.73	94
2003/04	26.37	30.05	30.25	12.97	0.75	100
2004/05	28.33	32.18	32.40	13.73	0.78	107
2005/06	30.42	34.46	34.71	14.53	0.81	115
2006/07	32.68	36.91	37.19	15.39	0.84	123
2011/12	46.71	51.99	52.37	20.46	1.00	173
2016/17	66.92	73.25	73.61	27.27	1.17	242
2020/21	89.03	96.37	96.73	34.38	1.33	318

Table 16 Coal requirement (PRCONS) (million tonnes)

Years	Case I	Case II	Case III		
			Domestic	Imported	Lignite
1999/2000	12.75	11.47	8.22	2.41	0.50
2000/01	13.56	12.20	8.57	2.69	0.56
2001/02	14.44	13.00	8.93	3.01	0.63
2002/03	15.37	13.83	9.29	3.36	0.70
2003/04	16.36	14.73	9.65	3.76	0.78
2004/05	17.18	15.46	9.87	4.14	0.86
2005/06	18.10	16.29	10.10	4.58	0.96
2006/07	19.13	17.22	10.35	5.09	1.06
2011/12	26.58	23.92	11.74	9.02	1.88
2016/17	37.32	33.59	11.76	16.17	3.37
2020/21	48.97	44.07	9.26	25.79	5.37

Table 17 Cement consumption with rising prices (PRGROW) (million tonnes)

Years	North	South	West	East	Neast	Total
1999/2000	19.88	22.78	22.87	10.32	0.65	76.50
2000/01	21.33	24.35	24.48	10.92	0.68	81.75
2001/02	22.89	26.02	26.26	11.54	0.70	87.42
2002/03	24.56	27.81	28.09	12.20	0.73	93.40
2003/04	26.35	29.72	30.05	12.90	0.75	99.78
2004/05	28.28	31.77	32.15	13.64	0.78	106.61
2005/06	30.34	33.95	34.39	14.42	0.81	113.91
2006/07	32.55	36.28	36.79	15.25	0.84	121.71
2011/12	46.29	50.56	51.44	20.14	1.00	169.43
2016/17	65.94	70.43	71.76	26.66	1.17	235.95
2020/21	87.31	91.79	93.70	33.41	1.33	307.55

Table 18 Coal requirement (PRGROW) (million tonnes)

Years	Case I	Case II	Case III		
			Domestic	Imported	Lignite
1999/2000	12.74	11.47	8.21	2.41	0.50
2000/01	13.53	12.18	8.55	2.69	0.56
2001/02	14.39	12.95	8.90	3.00	0.62
2002/03	15.30	13.77	9.25	3.35	0.70
2003/04	16.26	14.64	9.59	3.74	0.78
2004/05	17.05	15.34	9.79	4.11	0.86
2005/06	17.94	16.14	10.01	4.54	0.95
2006/07	18.93	17.04	10.24	5.04	1.05
2011/12	26.10	23.49	11.53	8.86	1.85
2016/17	36.35	32.72	11.46	15.75	3.28
2020/21	47.39	42.65	8.96	24.95	5.20

Table 19 Input data for Cement demand forecast (North_ high)

YEARS	NSDP (million)	POP (millions)	PCC (Kg)	PCY (Rs)	PRCONST	profit	PRGRO	DEXP (million)
1970-71	185517	139.74	23.80	1327	1.04	1.04	1.04	2148
1971-72	177464	141.20	23.78	1256	1.04	1.04	1.04	2269
1972-73	182429	144.09	24.74	1266	0.93	0.93	0.93	2445
1973-74	182680	147.30	22.19	1240	0.84	0.84	0.84	2778
1974-75	184517	150.20	18.90	1228	0.88	0.88	0.88	3288
1975-76	207185	154.00	25.32	1345	1.03	1.03	1.03	3487
1976-77	216212	157.80	29.08	1370	1.02	1.02	1.02	4864
1977-78	233964	161.60	28.06	1447	0.99	0.99	0.99	4858
1978-79	244578	165.70	28.68	1476	1.10	1.10	1.10	6109
1979-80	218898	170.00	25.26	1287	1.10	1.10	1.10	7596
1980-81	263420	176.50	23.14	1492	0.95	0.95	0.95	19496
1981-82	276110	181.10	27.51	1524	1.00	1.00	1.00	20936
1982-83	291360	186.00	29.83	1566	1.19	1.19	1.19	42752
1983-84	309810	190.40	30.05	1627	1.28	1.28	1.28	36973
1984-85	261638	195.10	29.45	1341	1.32	1.32	1.32	56940
1985-86	330940	199.63	33.40	1657	1.22	1.22	1.22	66970
1986-87	375970	204.30	39.05	1840	1.05	1.05	1.05	77880
1987-88	352510	209.10	39.23	1685	0.97	0.97	0.97	107661
1988-89	413040	212.70	45.13	1941	0.86	0.86	0.86	120340
1989-90	424910	217.59	46.51	1952	0.89	0.89	0.89	95820
1990-91	456280	223.53	48.89	2041	0.95	0.95	0.95	110292
1991-92	455320	227.60	53.50	2000	0.95	0.95	0.95	141394
1992-93	473750	233.03	53.54	2033	0.92	0.92	0.92	151109
1993-94	479260	237.67	56.77	2016	0.84	0.84	0.84	123204
1994-95	509640	241.62	58.11	2109	0.86	0.86	0.86	143860
1995-96	521260	246.06	61.70	2118	0.92	0.92	0.92	199940
1996-97	552930	247.34	68.69	2235	0.90	0.90	0.90	240621
1997-98	670576	252.14	74.40	2593	0.83	0.83	0.83	286339
1998-99	718051	257.03	78.88	2723	0.83	0.79	0.83	340743
1999-2000	768886	262.02		2861	0.83	0.78	0.84	405484
2000-01	823321	267.10		3005	0.83	0.78	0.85	482526
2001-02	881609	272.67		3152	0.83	0.78	0.86	574206
2002-03	944024	278.01		3310	0.83	0.77	0.87	683305
2003-04	1010858	283.46		3476	0.83	0.77	0.88	813133
2004-05	1082423	289.02		3651	0.83	0.77	0.89	967628
2005-06	1159055	294.68		3834	0.83	0.76	0.89	1151478
2006-07	1241112	300.53		4026	0.83	0.76	0.90	1370258
2007-08	1328979	306.51		4227	0.83	0.76	0.91	1630607
2008-09	1423066	312.61		4438	0.83	0.76	0.92	1940423
2009-10	1523814	318.83		4659	0.83	0.75	0.93	2309103
2010-11	1631695	325.18		4892	0.83	0.75	0.94	2747833
2011-12	1747214	331.76		5134	0 83	0.75	0.95	3269921
2012-13	1870911	338.40		5390	0.83	0.74	0.96	3891206

YEARS	NSDP (million)	POP (millions)	PCC (Kg)	PCY (Rs)	PRCONST	profit	PRGRO	DEXP (million)
2013-14	2003365	345.16		5658	0.83	0.74	0.97	4630535
2014-15	2145196	352.07		5940	0.83	0.74	0.98	5510336
2015-16	2297069	366.55		6110	0.83	0.73	0.99	6557300
2016-17	2459694	373.59		6419	0.83	0.73	1.00	7803187
2017-18	2633832	380.76		6744	0.83	0.73	1 01	9285793
2018-19	2820298	388.07		7085	0.83	0.73	1.02	11050094
2019-20	3019966	395.52		7444	0.83	0.72	1.03	13149611
2020-21	3233769	403.08		7822	0.83	0.72	1 04	15648038

Table 20 Input data for cement demand forecast (North_medium)

YEARS	NSDP (million)	POP (millions)	PCC(kg)	PCY (Rs)	PRCONST	PRFIT	PRGRO	DEXP (millions)
1970-71	185517	139.7	23.80	1327	1.04	1.04	1.04	2148
1971-72	177464	141.2	23.78	1256	1.04	1.04	1.04	2269
1972-73	182429	144.1	24.74	1266	0.93	0.93	0.93	2445
1973-74	182680	147.3	22.19	1240	0.84	0.84	0.84	2778
1974-75	184517	150.2	18.90	1228	0.88	0.88	0 88	3288
1975-76	207185	154.0	25.32	1345	1.03	1.03	1.03	3487
1976-77	216212	157.8	29.08	1370	1.02	1.02	1.02	4864
1977-78	233964	161.6	28.06	1447	0.99	0.99	0.99	4858
1978-79	244578	165.7	28.68	1476	1.10	1.10	1.10	6109
1979-80	218898	170.0	25.26	1287	1.10	1.10	1.10	7596
1980-81	263420	176.5	23.14	1492	0.95	0.95	0.95	19496
1981-82	276110	181.1	27.51	1524	1.00	1.00	1.00	20936
1982-83	291360	186.0	29.83	1566	1.19	1.19	1.19	42752
1983-84	309810	190.4	30.05	1627	1.28	1.28	1.28	36973
1984-85	261638	195.1	29.45	1341	1.32	1.32	1.32	56940
1985-86	330940	199.6	33.40	1657	1.22	1.22	1.22	66970
1986-87	375970	204.3	39.05	1840	1.05	1.05	1.05	77880
1987-88	352510	209.1	39.23	1685	0.97	0.97	0.97	107661
1988-89	413040	212.7	45.13	1941	0.86	0.86	0 86	120340
1989-90	424910	217.6	46.51	1952	0.89	0.89	0.89	95820
1990-91	456280	223.5	48.89	2041	0.95	0.95	0.95	110292
1991-92	455320	227.6	53.50	2000	0.95	0.95	0.95	141394
1992-93	473750	233.0	53.54	2033	0.92	0.92	0.92	151109
1993-94	479260	237.7	56.77	2016	0.84	0.84	0.84	123204
1994-95	509640	241.6	58.11	2109	0.86	0.86	0.86	143860
1995-96	521260	246.1	61.70	2118	0.92	0.92	0.92	199940
1996-97	552930	247.3	68.69	2235	0.90	0.90	0.90	240621
1997-98	664240	252.1	74.40	2568	0.83	0.83	0.83	305588
1998-99	704546	257.0	78.87	2672	0.83	0.79	0.83	388097
1999-2000	747298	262.0		2780	0.83	0.78	0.84	492883
2000-01	792644	267.1		2893	0.83	0.78	0.85	625962
2001-02	840741	272.7		3006	0.83	0.78	0.86	794971
2002-03	891757	278.0		3127	0.83	0.77	0.87	1009613
2003-04	945868	283.5		3253	0.83	0.77	0.88	1282209

YEARS	NSDP (million)	POP (millions)	PCC(kg)	PCY (Rs)	PRCONST	PRFIT	PRGRO	DEXP (millions)
2004-05	1003263	289.0		3384	0.83	0.77	0.89	1628406
2005-06	1064141	294.7		3520	0.83	0.76	0.89	2068075
2006-07	1128713	300.5		3661	0.83	0.76	0.90	2626455
2007-08	1197202	306.5		3808	0.83	0.76	0.91	3335598
2008-09	1269848	312.6		3960	0.83	0.76	0.92	4236210
2009-10	1346902	318.8		4118	0.83	0.75	0.93	5379986
2010-11	1428632	325.2		4283	0.83	0.75	0.94	6832583
2011-12	1515321	331.8		4453	0.83	0.75	0.95	8677380
2012-13	1607270	338.4		4630	0.83	0.74	0.96	11020273
2013-14	1704798	345.2		4815	0.83	0.74	0.97	13995746
2014-15	1808245	352.1		5007	0.83	0.74	0.98	17774598
2015-16	1917968	366.6		5101	0.83	0.73	0.99	22573739
2016-17	2034350	373.6		5309	0.83	0.73	1.00	28668649
2017-18	2157794	380.8		5525	0.83	0.73	1.01	36409184
2018-19	2288728	388.1		5750	0.83	0.73	1.02	46239664
2019-20	2427607	395.5		5984	0.83	0.72	1.03	58724373
2020-21	2574913	403.1		6228	0.83	0.72	1.04	74579954

Table 21 Input data for cement demand forecast (North_low)

YEARS	NSDP (millions)	POP (millions)	PCC (Kg)	PCY (Rs)	PRCONST	PRFIT	PRGRO	DEXP (millions)
1970-71	185517	139.7	23.80	1327	1.04	1.04	1.04	2148
1971-72	177464	141.2	23.78	1256	1.04	1.04	1.04	2269
1972-73	182429	144.1	24.74	1266	0.93	0.93	0.93	2445
1973-74	182680	147.3	22.19	1240	0.84	0.84	0.84	2778
1974-75	184517	150.2	18.90	1228	0.88	0.88	0.88	3288
1975-76	207185	154.0	25.32	1345	1.03	1.03	1.03	3487
1976-77	216212	157.8	29.08	1370	1.02	1.02	1.02	4864
1977-78	233964	161.6	28.06	1447	0.99	0.99	0.99	4858
1978-79	244578	165.7	28.68	1476	1.10	1.10	1.10	6109
1979-80	218898	170.0	25.26	1287	1.10	1.10	1.10	7596
1980-81	263420	176.5	23.14	1492	0.95	0.95	0.95	19496
1981-82	276110	181.1	27.51	1524	1.00	1.00	1.00	20936
1982-83	291360	186.0	29.83	1566	1.19	1.19	1.19	42752
1983-84	309810	190.4	30.05	1627	1.28	1.28	1.28	36973
1984-85	261638	195.1	29.45	1341	1.32	1.32	1.32	56940
1985-86	330940	199.6	33.40	1657	1.22	1.22	1.22	66970
1986-87	375970	204.3	39.05	1840	1.05	1.05	1.05	77880
1987-88	352510	209.1	39.23	1685	0.97	0.97	0.97	107661
1988-89	413040	212.7	45.13	1941	0.86	0.86	0.86	120340
1989-90	424910	217.6	46.51	1952	0.89	0.89	0.89	95820
1990-91	456280	223.5	48.89	2041	0.95	0.95	0.95	110292
1991-92	455320	227.6	53.50	2000	0.95	0.95	0.95	141394
1992-93	473750	233.0	53.54	2033	0.92	0.92	0.92	151109
1993-94	479260	237.7	56.77	2016	0.84	0.84	0.84	123204
1994-95	509640	241.6	58.11	2109	0.86	0.86	0.86	143860

YEARS	NSDP (millions)	POP (millions)	PCC (Kg)	PCY (Rs)	PRCONST	PRFIT	PRGRO	DEXP (millions)
1995-96	521260	246.1	61.70	2118	0.92	0.92	0.92	199940
1996-97	552930	247.3	68.69	2235	0.90	0.90	0.90	240621
1997-98	657905	252.1	74.40	2544	0.83	0.83	0.83	305588
1998-99	691171	257.0	78.87	2621	0.83	0.79	0.83	388097
1999-2000	726120	262.0		2702	0.83	0.78	0.84	492883
2000-01	762835	267.1		2784	0.83	0.78	0.85	625962
2001-02	801407	272.7		2865	0.83	0.78	0.86	794971
2002-03	841929	278.0		2952	0.83	0.77	0.87	1009613
2003-04	884500	283.5		3042	0.83	0.77	0.88	1282209
2004-05	929223	289.0		3134	0.83	0.77	0.89	1628406
2005-06	976208	294.7		3229	0.83	0.76	0.89	2068075
2006-07	1025569	300.5		3327	0.83	0.76	0.90	2626455
2007-08	1077426	306.5		3427	0.83	0.76	0.91	3335598
2008-09	1131904	312.6		3530	0.83	0.76	0.92	4236210
2009-10	1189137	318.8		3636	0.83	0.75	0.93	5379986
2010-11	1249264	325.2		3745	0.83	0.75	0.94	6832583
2011-12	1312432	331.8		3857	0.83	0.75	0.95	8677380
2012-13	1378793	338.4		3972	0.83	0.74	0.96	11020273
2013-14	1448510	345.2		4091	0.83	0.74	0.97	13995746
2014-15	1521752	352.1		4214	0.83	0.74	0.98	17774598
2015-16	1598698	366.6		4252	0.83	0.73	0.99	22573739
2016-17	1679534	373.6		4383	0.83	0.73	1.00	28668649
2017-18	1764457	380.8		4518	0.83	0.73	1.01	36409184
2018-19	1853674	388.1		4657	0.83	0.73	1.02	46239664
2019-20	1947403	395.5		4800	0.83	0.72	1.03	58724373
2020-21	2045871	403.1		4948	0.83	0.72	1.04	74579954

Table 22 Input data for cement demand forecast (South_high)

	NSDP (millions)	POP (millions)	PCC(kg)	PCY(Rs)	DEXP(millions)	UI (%)	PRCONST	PRFIT	prgro
1970-71	183252	134	26.60	1367	1415	0.23	1.04	1.04	1.04
1971-72	190071	135	29.76	1405	1713	0.23	1.04	1.04	1.04
1972-73	184120	138	28.49	1335	2027	0.24	0.93	0.93	0.93
1973-74	202646	141	24.75	1439	2059	0.24	0.84	0.84	0.84
1974-75	195816	144	24.58	1362	2173	0.24	0.88	0.88	0.88
1975-76	211469	147	26.37	1441	3782	0.25	1.03	1.03	1.03
1976-77	205312	150	31.13	1371	3339	0.25	1.02	1.02	1.02
1977-78	228276	153	32.41	1494	4155	0.25	0.99	0.99	0.99
1978-79	239986	156	35.59	1542	4951	0.25	1.10	1.10	1.10
1979-80	242519	159	34.99	1529	5709	0.26	1.10	1.10	1.10
1980-81	239520	163	35.67	1466	16162	0.27	0.95	0.95	0.95
1981-82	261830	166	36.40	1574	17393	0.27	1.00	1.00	1.00
1982-83	260830	169	34.61	1541	45310	0.27	1.19	1.19	1.19
1983-84	271210	173	36.74	1570	57320	0.27	1.28	1.28	1.28
1984-85	286060	176	45.79	1623	65580	0.28	1.32	1.32	1.32
1985-86	292570	179	46.62	1631	74270	0.28	1.22	1.22	1.22

	NSDP (millions)	POP (millions)	PCC(kg)	PCY(Rs)	DEXP(millions)	UI (%)	PRCONST	PRFIT	prgro
1986-87	293610	183	50.95	1607	84650	0.28	1.05	1.05	1.05
1987-88	314840	186	54.30	1690	103840	0.28	0.97	0.97	0.97
1988-89	349080	189	57.93	1848	114550	0.29	0.86	0.86	0.86
1989-90	369490	192	61.18	1924	93217	0.29	0.89	0.89	0.89
1990-91	385080	195	65.33	1976	101165	0.30	0.95	0.95	0.95
1991-92	404010	197	68.31	2053	167200	0.30	0.95	0.95	0.95
1992-93	415090	200	71.23	2078	173088	0.30	0.92	0.92	0.92
1993-94	452710	202	74.16	2244	183947	0.30	0.84	0.84	0.84
1994-95	482910	206	79.87	2350	208000	0.31	0.86	0.86	0.86
1995-96	501780	208	86.52	2408	233477	0.31	0.92	0.92	0.92
1996-97	529090	211	90.99	2505	297398	0.31	0.90	0.90	0.90
1997-98	410719	214	97.25	2534	365800	0.20	0.83	0.83	0.83
1998-99	435915	216	102.54	2659	449933		0.83	0.79	0.83
1999-2000	462658	219		2791	553418		0.83	0.78	0.84
2000-01	491041	221		2929	680704		0.83	0.78	0.85
2001-02	521165	224		3063	837266		0.83	0.78	0.86
2002-03	553138	227		3217	1029838		0.83	0.77	0.87
2003-04	587071	229		3380	1266700		0.83	0.77	0.88
2004-05	623087	231		3550	1558041		0.83	0.77	0.89
2005-06	661312	234		3729	1916391		0.83	0.76	0.89
2006-07	701882	236		3917	2357161		0.83	0.76	0.90
2007-08	744941	238		4119	2899307		0.83	0.76	0.91
2008-09	790641	241		4331	3566148		0.83	0.76	0.92
2009-10	839145	243		4553	4386362		0.83	0.75	0.93
2010-11	890625	245		4788	5395226		0.83	0.75	0.94
2011-12	945263	248		5033	6636127		0.83	0.75	0.95
2012-13	1003253	250		5299	8162437		0.83	0.74	0.96
2013-14	1064800	252		5578	10039797		0.83	0.74	0.97
2014-15	1130123	254		5872	12348950		0.83	0.74	0.98
2015-16	1199454	258		6129	15189209		0.83	0.73	0.99
2016-17	1273038	260		6462	18682727		0.83	0.73	1.00
2017-18	1351136	261		6814	22979754		0.83	0.73	1.01
2018-19.	1434025	263		7184	28265098		0.83	0.73	1.02
2019-20	1521999	265		7581	34766071		0.83	0.72	1.03
2020-21	1615371	267		7985	42762267		0.83	0.72	1.04

Table 23 Input data for cement demand forecast (South _medium)

	NSDP (millions)	POP (millions)	PCC (Kg)	PCY (Rs)	DEXP (millions)	UI (%)	PRCONST	PRFIT	prgro
1970-71	183252	134	26.60	1367	1415	0.23	1.04	1.04	1.04
1971-72	190071	135	29.76	1405	1713	0.23	1.04	1.04	1.04
1972-73	184120	138	28.49	1335	2027	0.24	0.93	0.93	0.93
1973-74	202646	141	24.75	1439	2059	0.24	0.84	0.84	0.84
1974-75	195816	144	24.58	1362	2173	0.24	0.88	0.88	0.88
1975-76	211469	147	26.37	1441	3782	0.25	1.03	1.03	1.03
1976-77	205312	150	31.13	1371	3339	0.25	1.02	1.02	1.02

	NSDP (millions)	POP (millions)	PCC (Kg)	PCY (Rs)	DEXP (millions)	UI (%)	PRCONST	PRFIT	prgro
1977-78	228276	153	32.41	1494	4155	0.25	0.99	0.99	0.99
1978-79	239986	156	35.59	1542	4951	0.25	1.10	1.10	1.10
1979-80	242519	159	34 99	1529	5709	0.26	1.10	1.10	1.10
1980-81	239520	163	35.67	1466	16162	0.27	0.95	0.95	0.95
1981-82	261830	166	36.40	1574	17393	0.27	1.00	1.00	1.00
1982-83	260830	169	34.61	1541	45310	0 27	1.19	1.19	1.19
1983-84	271210	173	36.74	1570	57320	0.27	1.28	1.28	1.28
1984-85	286060	176	45 79	1623	65580	0.28	1.32	1.32	1.32
1985-86	292570	179	46.62	1631	74270	0.28	1.22	1.22	1.22
1986-87	293610	183	50.95	1607	84650	0.28	1.05	1.05	1.05
1987-88	314840	186	54.30	1690	103840	0.28	0.97	0.97	0.97
1988-89	349080	189	57.93	1848	114550	0.29	0.86	0.86	0.86
1989-90	369490	192	61.18	1924	93217	0.29	0.89	0.89	0.89
1990-91	385080	195	65.33	1976	101165	0.30	0.95	0.95	0.95
1991-92	404010	197	68.31	2053	167200	0.30	0.95	0.95	0.95
1992-93	415090	200	71.23	2078	173088	0.30	0.92	0.92	0.92
1993-94	452710	202	74.16	2244	183947	0.30	0.84	0.84	0.84
1994-95	482910	206	79.87	2350	208000	0.31	0.86	0.86	0.86
1995-96	501780	208	86.52	2408	233477	0.31	0.92	0.92	0.92
1996-97	529090	211	90.99	2505	297398	0.31	0.90	0.90	0.90
1997-98	407339	214	97.25	2513	365800	0.20	0.83	0.83	0.83
1998-99	428771	216	102.54	2616	449933		0.83	0.79	0.83
1999-2000	451330	219		2722	553418		0.83	0.78	0.84
2000-01	475076	221		2833	680704		0.83	0.78	0.85
2001-02	500072	224		2939	837266		0.83	0.78	0.86
2002-03	526383	227		3062	1029838		0.83	0.77	0.87
2003-04	554078	229		3190	1266700		0.83	0.77	0.88
2004-05	583230	231		3323	1558041		0.83	0.77	0.89
2005-06	613916	234		3462	1916391		0.83	0.76	0.89
2006-07	646217	236		3606	2357161		0.83	0.76	0.90
2007-08	680217	238		3761	2899307		0.83	0.76	0.91
2008-09	716006	241		3922	3566148		0.83	0.76	0.92
2009-10	753678	243		4090	4386362		0.83	0.75	0.93
2010-11	793332	245		4265	5395226		0.83	0.75	0.94
2011-12	835073	248		4446	6636127		0.83	0.75	0.95
2012-13	879009	250		4642	8162437		0.83	0.74	0.96
2013-14	925257	252		4847	10039797		0.83	0.74	0.97
2014-15	973939	254		5060	12348950		0.83	0.74	0.98
2015-16	1025182	258		5238	15189209		0.83	0.73	0.99
2016-17	1079121	260		5478	18682727		0.83	0.73	1.00
2017-18	1135898	261		5728	22979754		0.83	0.73	1.01
2018-19.	1195662	263		5990	28265098		0.83	0.73	1.02
2019-20	1258571	265		6269	34766071		0.83	0.72	1.03
2020-21	1324789	267		6549	42762267		0.83	0.72	1.04

Table 24 Input data for cement demand forecast (South _low)

	NSDP (millions)	POP (millions)	PCC (Kg)	PCY (Rs)	DEXP (millions)	UI (%)	PRCONST	PRFIT	prgro
1970-71	183252	134	26.60	1367	1415	0.23	1.04	1.04	1.04
1971-72	190071	135	29.76	1405	1713	0.23	1.04	1.04	1.04
1972-73	184120	138	28.49	1335	2027	0.24	0.93	0.93	0.93
1973-74	202646	141	24.75	1439	2059	0.24	0.84	0.84	0.84
1974-75	195816	144	24.58	1362	2173	0.24	0.88	0.88	0.88
1975-76	211469	147	26.37	1441	3782	0.25	1.03	1.03	1.03
1976-77	205312	150	31.13	1371	3339	0.25	1.02	1.02	1.02
1977-78	228276	153	32.41	1494	4155	0.25	0.99	0.99	0.99
1978-79	239986	156	35.59	1542	4951	0.25	1.10	1.10	1.10
1979-80	242519	159	34.99	1529	5709	0.26	1.10	1.10	1.10
1980-81	239520	163	35.67	1466	16162	0.27	0.95	0.95	0.95
1981-82	261830	166	36.40	1574	17393	0.27	1.00	1.00	1.00
1982-83	260830	169	34.61	1541	45310	0.27	1.19	1.19	1.19
1983-84	271210	173	36.74	1570	57320	0.27	1.28	1.28	1.28
1984-85	286060	176	45.79	1623	65580	0.28	1.32	1.32	1.32
1985-86	292570	179	46.62	1631	74270	0.28	1.22	1.22	1.22
1986-87	293610	183	50.95	1607	84650	0.28	1.05	1.05	1.05
1987-88	314840	186	54.30	1690	103840	0.28	0.97	0.97	0.97
1988-89	349080	189	57.93	1848	114550	0.29	0.86	0.86	0.86
1989-90	369490	192	61.18	1924	93217	0.29	0.89	0.89	0.89
1990-91	385080	195	65.33	1976	101165	0.30	0.95	0.95	0.95
1991-92	404010	197	68.31	2053	167200	0.30	0.95	0.95	0.95
1992-93	415090	200	71.23	2078	173088	0.30	0.92	0.92	0.92
1993-94	452710	202	74.16	2244	183947	0.30	0.84	0.84	0.84
1994-95	482910	206	79.87	2350	208000	0.31	0.86	0.86	0.86
1995-96	501780	208	86.52	2408	233477	0.31	0.92	0.92	0.92
1996-97	529090	211	90.99	2505	297398	0.31	0.90	0.90	0.90
1997-98	403955	214	97.25	2493	365800	0.20	0.83	0.83	0.83
1998-99	421677	216	102.54	2573	449933		0.83	0.79	0.83
1999-2000	440176	219		2655	553418		0.83	0.78	0.84
2000-01	459487	221		2740	680704		0.83	0.78	0.85
2001-02	479645	224		2819	837266		0.83	0.78	0.86
2002-03	500687	227		2912	1029838		0.83	0.77	0.87
2003-04	522652	229		3009	1266700		0.83	0.77	0.88
2004-05	545581	231		3108	1558041		0.83	0.77	0.89
2005-06	569516	234		3211	1916391		0.83	0.76	0.89
2006-07	594501	236		3318	2357161		0.83	0.76	0.90
2007-08	620582	238		3431	2899307		0.83	0.76	0.91
2008-09	647807	241		3548	3566148		0.83	0.76	0.92
2009-10	676227	243		3669	4386362		0.83	0.75	0.93
2010-11	705893	245		3795	5395226		0.83	0.75	0.94
2011-12	736861	248		3923	6636127		0.83	0.75	0.95
2012-13	769187	250		4062	8162437		0.83	0.74	0.96

	NSDP (millions)	POP (millions)	PCC (Kg)	PCY (Rs)	DEXP (millions)	UI (%)	PRCONST	PRFIT	prgro
2013-14	802932	252		4206	10039797		0.83	0.74	0.97
2014-15	838157	254		4355	12348950		0.83	0.74	0.98
2015-16	874927	258		4471	15189209		0.83	0.73	0.99
2016-17	913311	260		4636	18682727		0.83	0.73	1.00
2017-18	953378	261		4808	22979754		0.83	0.73	1.01
2018-19.	995203	263		4986	28265098		0.83	0.73	1.02
2019-20	1038863	265		5175	34766071		0.83	0.72	1.03
2020-21	1084438	267		5361	42762267		0.83	0.72	1.04

Table 25 Input data for cement demand forecast (NorthEast _high)

Years	NSDP (millions)	DEXP (millions)	POP (millions)	PCC (kg)	PCY (Rs)	UI (%)	PRCONST	PRFIT	PRGRO
1970-71	16971	144	14	19	1176	0.09	1.04	1.04	1.04
1971-72	17756	162	15	17	1216	0.09	1.04	1.04	1.04
1972-73	18577	171	15	19	1238	0.09	0.93	0.93	0.93
1973-74	19050	197	16	11	1229	0.09	0.84	0.84	0.84
1974-75	18960	248	16	12	1185	0.10	0.88	0.88	0.88
1975-76	20649	273	17	17	1251	0.10	1.03	1.03	1.03
1976-77	20506	379	17	16	1206	0.10	1.02	1.02	1.02
1977-78	21604	467	18	16	1234	0.10	0.99	0.99	0.99
1978-79	21762	640	18	18	1202	0.10	1.10	1.10	1.10
1979-80	20799	551	19	15	1112	0.10	1.10	1.10	1.10
1980-81	22980	1934	18	18	1276	0.11	0.95	0.95	0.95
1981-82	25580	2103	18	17	1397	0.11	1.00	1.00	1.00
1982-83	26760	4600	19	17	1438	0.11	1.19	1.19	1.19
1983-84	27930	6195	19	24	1470	0.11	1.28	1.28	1.28
1984-85	28070	7480	19	27	1446	0.11	1.32	1.32	1.32
1985-86	29920	8832	20	23	1511	0.11	1.22	1.22	1.22
1986-87	29070	10297	20	27	1439	0.11	1.05	1.05	1.05
1987-88	30370	12840	21	24	1467	0.11	0.97	0.97	0.97
1988-89	30600	12990	21	28	1443	0.11	0.86	0.86	0.86
1989-90	32860	13542	22	33	1514	0.11	0.89	0.89	0.89
1990-91	34260	13857	22	24	1543	0.11	0.95	0.95	0.95
1991-92	35770	16046	23	33	1575	0.11	0.95	0.95	0.95
1992-93	36130	15789	23	27	1557	0.11	0.92	0.92	0.92
1993-94	37540	18547	24	21	1584	0.11	0.84	0.84	0.84
1994-95	38410	20517	24	22	1587	0.11	0.86	0.86	0.86
1995-96	39720	23449	25	18	1608	0.11	0.92	0.92	0.92
1996-97	41070	22508	25	16	1661	0.11	0.90	0.90	0.90
1997-98	24710	27685	25	21	1831	0.11	0.83	0.83	0.83
1998-99	25963	34053	25	24	1897	0.11	0.83	0.79	0.83
99-2000	27279	41885	26		1966		0.83	0.78	0.84
2000-01	28662	51519	26		2037		0.83	0.78	0.85
2001-02	30115	63368	27		2107		0.83	0.78	0.86
2002-03	31642	77943	27		2183		0.83	0.77	0.87
2003-04	33246	95869	27		2262		0.83	0.77	0.88

Years	NSDP (millions)	DEXP (millions)	POP (millions)	PCC (kg)	PCY (Rs)	UI (%)	PRCONST	PRFIT	PRGRO
2004-05	34932	117919	28		2344		0.83	0.77	0.89
2005-06	36703	145041	28		2429		0.83	0.76	0.89
2006-07	38564	178400	29		2511		0.83	0.76	0.90
2007-08	40519	219432	29		2604		0.83	0.76	0.91
2008-09	42574	269902	29		2701		0.83	0 76	0.92
2009-10	44732	331979	30		2802		0.83	0.75	0.93
2010-11	47001	408335	30		2906		0.83	0.75	0.94
2011-12	49384	502252	31		3000		0.83	0.75	0.95
2012-13	51887	617769	31		3114		0.83	0.74	0.96
2013-14	54518	759856	31		3234		0.83	0.74	0.97
2014-15	57282	934623	32		3357		0.83	0.74	0.98
2015-16	60187	1149587	32		3486		0.83	0.73	0.99
2016-17	63238	1413992	33		3611		0.83	0.73	1 00
2017-18	66445	1739210	33		3764		0.83	0.73	1.01
2018-19	69813	2139228	33		3924		0.83	0.73	1.02
2019-20	73353	2631250	33		4090		0.83	0 72	1.03
2020-21	77072	3236438	34		4208		0.83	0.72	1.04

Table 26 Input data for cement demand forecast (NorthEast_medium)

Years	NSDP (millions)	DEXP (millions)	POP (millions)	PCC (kg)	PCY (Rs)	UI (%)	PRCONST	PRFIT	PRGRO
1970-71	16971	144	14	19	1176	0.09	1.04	1.04	1.04
1971-72	17756	162	15	17	1216	0.09	1.04	1.04	1.04
1972-73	18577	171	15	19	1238	0.09	0.93	0.93	0.93
1973-74	19050	197	16	11	1229	0.09	0.84	0.84	0.84
1974-75	18960	248	16	12	1185	0.1	0.88	0.88	0.88
1975-76	20649	273	17	17	1251	0.10	1.03	1.03	1.03
1976-77	20506	379	17	16	1206	0.10	1.02	1.02	1.02
1977-78	21604	467	18	16	1234	0.10	0.99	0.99	0.99
1978-79	21762	640	18	18	1202	0.10	1.10	1.10	1.10
1979-80	20799	551	19	15	1112	0.10	1.10	1.10	1.10
1980-81	22980	1934	18	18	1276	0.11	0.95	0.95	0 95
1981-82	25580	2103	18	17	1397	0.11	1.00	1 00	1 00
1982-83	26760	4600	19	17	1438	0.11	1.19	1.19	1.19
1983-84	27930	6195	19	24	1470	0.11	1.28	1.28	1.28
1984-85	28070	7480	19	27	1446	0.11	1.32	1.32	1.32
1985-86	29920	8832	20	23	1511	0.11	1.22	1.22	1.22
1986-87	29070	10297	20	27	1439	0.11	1.05	1.05	1.05
1987-88	30370	12840	21	24	1467	0.11	0.97	0.97	0.97
1988-89	30600	12990	21	28	1443	0.11	0.86	0.86	0.86
1989-90	32860	13542	22	33	1514	0.11	0.89	0.89	0.89
1990-91	34260	13857	22	24	1543	0.11	0.95	0.95	0.95
1991-92	35770	16046	23	33	1575	0.11	0.95	0 95	0.95
1992-93	36130	15789	23	27	1557	0.11	0.92	0 92	0.92
1993-94	37540	18547	24	21	1584	0.11	0.84	0.84	0.84
1994-95	38410	20517	24	22	1587	0.11	0.86	0.86	0.86

Years	NSDP (millions)	DEXP (millions)	POP (millions)	PCC (kg)	PCY (Rs)	UI (%)	PRCONST	PRFIT	PRGRO
1995-96	39720	23449	25	18	1608	0.11	0.92	0.92	0.92
1996-97	41070	22508	25	16	1661	0.11	0.90	0.90	0.90
1997-98	24541	27685	25	21	1818	0.11	0.83	0.83	0.83
1998-99	25609	34053	25	24	1871	0.11	0.83	0.79	0.83
99-2000	26723	41885	26		1926		0.83	0.78	0.84
2000-01	27886	51519	26		1982		0.83	0.78	0.85
2001-02	29099	63368	27		2036		0.83	0.78	0.86
2002-03	30366	77943	27		2095		0.83	0.77	0.87
2003-04	31687	95869	27		2156		0.83	0.77	0.88
2004-05	33066	117919	28		2219		0.83	0.77	0.89
2005-06	34505	145041	28		2283		0.83	0.76	0.89
2006-07	36006	178400	29		2344		0.83	0.76	0.90
2007-08	37573	219432	29		2415		0.83	0.76	0.91
2008-09	39208	269902	29		2488		0.83	0.76	0.92
2009-10	40914	331979	30		2563		0.83	0.75	0.93
2010-11	42694	408335	30		2640		0.83	0.75	0.94
2011-12	44552	502252	31		2706		0.83	0.75	0.95
2012-13	46491	617769	31		2790		0.83	0.74	0.96
2013-14	48514	759856	31		2877		0.83	0.74	0.97
2014-15	50625	934623	32		2967		0.83	0.74	0.98
2015-16	52828	1149587	32		3059		0.83	0.73	0.99
2016-17	55127	1413992	33		3148		0.83	0.73	1.00
2017-18	57525	1739210	33		3259		0.83	0.73	1.01
2018-19	60029	2139228	33		3374		0.83	0.73	1.02
2019-20	62641	2631250	33		3492		0.83	0.72	1.03
2020-21	65366	3236438	34		3569		0.83	0.72	1.04

Table 27 Input data for cement demand forecast (NorthEast_low)

Years	NSDP (millions)	DEXP (millions)	POP (millions)	PCC (kg)	PCY (Rs)	PRCONST	PRFIT	PRGRO
1970-71	16971	144	14	19	1176	1.04	1.04	1.04
1971-72	17756	162	15	17	1216	1.04	1.04	1.04
1972-73	18577	171	15	19	1238	0.93	0.93	0.93
1973-74	19050	197	16	11	1229	0.84	0.84	0.84
1974-75	18960	248	16	12	1185	0.88	0.88	0.88
1975-76	20649	273	17	17	1251	1.03	1.03	1.03
1976-77	20506	379	17	16	1206	1.02	1.02	1.02
1977-78	21604	467	18	16	1234	0.99	0.99	0.99
1978-79	21762	640	18	18	1202	1.10	1.10	1.10
1979-80	20799	551	19	15	1112	1.10	1.10	1.10
1980-81	22980	1934	18	18	1276	0.95	0.95	0.95
1981-82	25580	2103	18	17	1397	1.00	1.00	1.00
1982-83	26760	4600	19	17	1438	1.19	1.19	1.19
1983-84	27930	6195	19	24	1470	1.28	1.28	1.28
1984-85	28070	7480	19	27	1446	1.32	1.32	1.32
1985-86	29920	8832	20	23	1511	1.22	1.22	1.22

Years	NSDP (millions)	DEXP (millions)	POP (millions)	PCC (kg)	PCY (Rs)	PRCONST	PRFIT	PRGRO
1986-87	29070	10297	20	27	1439	1.05	1.05	1.05
1987-88	30370	12840	21	24	1467	0.97	0.97	0.97
1988-89	30600	12990	21	28	1443	0.86	0.86	0.86
1989-90	32860	13542	22	33	1514	0.89	0.89	0.89
1990-91	34260	13857	22	24	1543	0.95	0.95	0.95
1991-92	35770	16046	23	33	1575	0.95	0.95	0.95
1992-93	36130	15789	23	27	1557	0.92	0.92	0.92
1993-94	37540	18547	24	21	1584	0.84	0.84	0.84
1994-95	38410	20517	24	22	1587	0.86	0.86	0.86
1995-96	39720	23449	25	18	1608	0.92	0.92	0.92
1996-97	41070	22508	25	16	1661	0.90	0.90	0.90
1997-98	24371	27685	25	21	1806	0.83	0.83	0.83
1998-99	25256	34053	25	24	1846	0.83	0.79	0.83
99-2000	26173	41885	26		1886	0.83	0.78	0 84
2000-01	27124	51519	26		1928	0.83	0.78	0.85
2001-02	28108	63368	27		1966	0.83	0.78	0.86
2002-03	29129	77943	27		2010	0 83	0.77	0.87
2003-04	30187	95869	27		2054	0.83	0.77	0.88
2004-05	31283	117919	28		2099	0.83	0.77	0.89
2005-06	32419	145041	28		2145	0.83	0.76	0.89
2006-07	33596	178400	29		2187	0.83	0.76	0.90
2007-08	34815	219432	29		2238	0.83	0.76	0.91
2008-09	36080	269902	29		2289	0.83	0.76	0.92
2009-10	37390	331979	30		2342	0.83	0.75	0.93
2010-11	38747	408335	30		2396	0.83	0.75	0.94
2011-12	40154	502252	31		2439	0.83	0.75	0.95
2012-13	41612	617769	31		2498	0.83	0 74	0.96
2013-14	43123	759856	31		2558	0.83	0.74	0.97
2014-15	44689	934623	32		2619	0.83	0.74	0.98
2015-16	46311	1149587	32		2682	0.83	0.73	0 99
2016-17	47993	1413992	33		2740	0.83	0.73	1.00
2017-18	49735	1739210	33		2817	0.83	0.73	1.01
2018-19	51541	2139228	33		2897	0.83	0.73	1.02
2019-20	53413	2631250	33		2978	0.83	0.72	1.03
2020-21	55352	3236438	34		3022	0.83	0.72	1.04

Table 28 Input data for cement demand forecast (West_high)

YEARS	NSDP (millions)	DEXP (millions)	POP (millions)	PCY (Rs)	PRGRO	PRCONST	PRFIT	PCC (kg)
1970-71	193352	1529	118	1634	1.04	1 04	1.04	30
1971-72	201084	1828	119	1692	1.04	1.04	1.04	33
1972-73	184001	2179	121	1515	0.93	0.93	0.93	33
1973-74	205400	2077	124	1651	0.84	0.84	0.84	29
1974-75	209237	2930	127	1643	0.88	0 88	0.88	24
1975-76	231305	3491	131	1772	1.03	1.03	1.03	30
1976-77	236729	3987	133	1774	1.02	1.02	1.02	32

YEARS	NSDP (millions)	DEXP (millions)	POP (millions)	PCY (Rs)	PRGRO	PRCONST	PRFIT	PCC (kg)
1977-78	248683	4657	136	1823	0.99	0.99	0.99	35
1978-79	272848	5436	140	1953	1.10	1.10	1.10	37
1979-80	263969	6542	143	1847	1.10	1.10	1.10	35
1980-81	287217	20932	148	1937	0.95	0.95	0.95	35
1981-82	301081	23524	152	1986	1.00	1.00	1.00	38
1982-83	307168	46010	154	1989	1.19	1.19	1.19	41
1983-84	334783	64867	158	2120	1.28	1.28	1.28	48
1984-85	333097	63440	161	2066	1.32	1.32	1.32	53
1985-86	351003	74190	165	2126	1.22	1.22	1.22	54
1986-87	354977	84130	169	2097	1.05	1.05	1.05	53
1987-88	368726	111760	173	2128	0.97	0.97	0.97	56
1988-89	427621	124260	176	2425	0.86	0.86	0.86	60
1989-90	463500	113982	179	2586	0.89	0.89	0.89	64
1990-91	492070	117250	184	2680	0.95	0.95	0.95	67
1991-92	473890	173511	188	2526	0.95	0.95	0.95	71
1992-93	555510	164921	191	2903	0.92	0.92	0.92	72
1993-94	588100	192226	195	3014	0.84	0.84	0.84	75
1994-95	640570	203585	199	3221	0.86	0.86	0.86	80
1995-96	678060	236880	202	3349	0.92	0.92	0.92	91
1996-97	845549	288574	206	4098	0.90	0.90	0.90	96
1997-98	1070287	379763	209	3784	0.83	0.83	0.83	102
1998-99	1143197	499768	212	3986	0.83	0.83	0.79	112
1999-2000	1221075	657695	215	4199	0.84	0.83	0.78	110
2000-01	1304257	865527	218	4424	0.85	0.83	0.78	
2001-02	1393106	1139033	223	4628	0.86	0.83	0.78	
2002-03	1488007	1498968	226	4876	0.87	0.83	0.77	
2003-04	1589373	1972642	229	5136	0.88	0.83	0.77	
2004-05	1697645	2595997	232	5411	0.89	0.83	0.77	
2005-06	1813292	3416332	235	5700	0.89	0.83	0.76	
2006-07	1936818	4495893	239	6004	0.90	0.83	0.76	
2007-08	2068758	5916595	242	6333	0.91	0.83	0.76	
2008-09	2209686	7786239	245	6680	0.92	0.83	0.76	
2009-10	2360215	10246690	248	7045	0.93	0.83	0.75	
2010-11	2520998	13484644	251	7431	0.94	0.83	0.75	
2011-12	2692734	17745792	254	7835	0.95	0.83	0.75	
2012-13	2876168	23353462	257	8272	0.96	0.83	0.74	
2013-14	3072099	30733156	260	8733	0.97	0.83	0.74	
2014-15	3281377	40444834	263	9220	0.98	0.83	0.74	
2015-16	3504912	53225401	266	9734	0.99	0.83	0.73	
2016-17	3743674	70044628	269	10274	1.00	0.83	0.73	
2017-18	3998701	92178731	272	10867	1.01	0.83	0.73	
2018-19	4271102	121307210	275	11495	1.02	0.83	0.73	
2019-20	4562059	159640288	277	12159	1.03	0.83	0.72	
2020-21	4872836	210086619	283	12732	1.04	0.83	0.72	

Table 29 Input data for cement demand forecast (West_medium)

YEARS	NSDP (millions)	DEXP (millions)	POP (millions)	PCY (Rs)	prgro	PRCONST	PRFIT	PCC (kg)
1970-71	193352	1529	118.3	1634	1.04	1.04	1.04	30
1971-72	201084	1828	118.8	1692	1.04	1.04	1.04	33
1972-73	184001	2179	121.4	1515	0.93	0.93	0.93	33
1973-74	205400	2077	124.4	1651	0.84	0.84	0.84	29
1974-75	209237	2930	127.3	1643	0.88	0.88	0.88	24
1975-76	231305	3491	130.5	1772	1.03	1.03	1.03	30
1976-77	236729	3987	133.4	1774	1.02	1.02	1.02	32
1977-78	248683	4657	136.4	1823	0.99	0.99	0.99	35
1978-79	272848	5436	139.7	1953	1.10	1.10	1.10	37
1979-80	263969	6542	142.9	1847	1.10	1.10	1.10	35
1980-81	287217	20932	148.3	1937	0.95	0.95	0.95	35
1981-82	301081	23524	151.6	1986	1.00	1.00	1.00	38
1982-83	307168	46010	154.4	1989	1.19	1.19	1.19	41
1983-84	334783	64867	157.9	2120	1.28	1.28	1.28	48
1984-85	333097	63440	161.2	2066	1.32	1.32	1.32	53
1985-86	351003	74190	165.0	2126	1.22	1.22	1.22	54
1986-87	354977	84130	169.3	2097	1.05	1.05	1.05	53
1987-88	368726	111760	173.2	2128	0.97	0.97	0.97	56
1988-89	427621	124260	176.3	2425	0.86	0.86	0.86	60
1989-90	463500	113982	179.2	2586	0.89	0.89	0.89	64
1990-91	492070	117250	183.6	2680	0.95	0.95	0.95	67
1991-92	473890	173511	187.6	2526	0.95	0.95	0.95	71
1992-93	555510	164921	191.3	2903	0.92	0.92	0.92	72
1993-94	588100	192226	195.1	3014	0.84	0.84	0.84	75
1994-95	640570	203585	198.8	3221	0.86	0.86	0.86	80
1995-96	678060	236880	202.4	3349	0.92	0.92	0.92	91
1996-97	845549	288574	206.3	4098	0.90	0.90	0.90	96
1997-98	902877	366489	209.2	4316	0.83	0.83	0.83	102
1998-99	964092	465441	212.1	4545	0.83	0.83	0.79	112
1999-2000	1029458	591110	215.0	4787	0.84	0.83	0.78	110
2000-01	1099255	750710	218.0	5041	0.85	0.83	0.78	
2001-02	1173785	953401	222.6	5272	0.86	0.83	0.78	
2002-03	1253367	1210819	225.7	5553	0.87	0.83	0.77	
2003-04	1338345	1537741	228.8	5848	0.88	0.83	0.77	
2004-05	1429085	1952931	232.0	6159	0.89	0.83	0.77	
2005-06	1525977	2480222	235.2	6486	0.89	0.83	0.76	
2006-07	1629438	3149882	238.6	6830	0.90	0.83	0.76	
2007-08	1739914	4000350	241.6	7202	0.91	0.83	0.76	
2008-09	1857881	5080444	244.6	7594	0.92	0.83	0.76	
2009-10	1983845	6452164	247.8	8007	0.93	0.83	0.75	
2010-11	2118350	8194249	250.9	8442	0.94	0.83	0.75	
2011-12	2261974	10406696	254.2	8899	0.95	0.83	0.75	
2012-13	2415336	13216504	257.2	9392	0.96	0.83	0.74	

YEARS	NSDP (millions)	DEXP (millions)	POP (millions)	PCY (Rs)	prgro	PRCONST	PRFIT	PCC (kg)
2013-14	2579095	16784960	260.2	9913	0.97	0.83	0.74	
2014-15	2753958	21316899	263.2	10463	0.98	0.83	0.74	
2015-16	2940676	27072462	266.3	11043	0.99	0.83	0.73	
2016-17	3140054	34382026	269.5	11651	1.00	0.83	0.73	
2017-18	3352950	43665173	272.1	12321	1.01	0.83	0.73	
2018-19	3580280	55454770	274.8	13028	1.02	0.83	0.73	
2019-20	3823023	70427558	277.5	13777	1.03	0.83	0.72	
2020-21	4082224	89442999	283.1	14422	1.04	0.83	0.72	

Table 30 Input data for cement demand forecast (West_ low)

YEARS	NSDP (millions)	DEXP (millions)	POP (millions)	PCY (Rs)	PRGRO	PRCONST	PRFIT	PCC (kg)
1970-71	193352	1529	118	1634	1.04	1.04	1.04	30
1971-72	201084	1828	119	1692	1.04	1.04	1.04	33
1972-73	184001	2179	121	1515	0.93	0.93	0.93	33
1973-74	205400	2077	124	1651	0.84	0.84	0.84	29
1974-75	209237	2930	127	1643	0.88	0.88	0.88	24
1975-76	231305	3491	131	1772	1.03	1.03	1.03	30
1976-77	236729	3987	133	1774	1.02	1.02	1.02	32
1977-78	248683	4657	136	1823	0.99	0.99	0.99	35
1978-79	272848	5436	140	1953	1.10	1.10	1.10	37
1979-80	263969	6542	143	1847	1.10	1.10	1.10	35
1980-81	287217	20932	148	1937	0.95	0.95	0.95	35
1981-82	301081	23524	152	1986	1.00	1.00	1.00	38
1982-83	307168	46010	154	1989	1.19	1.19	1.19	41
1983-84	334783	64867	158	2120	1.28	1.28	1.28	48
1984-85	333097	63440	161	2066	1.32	1.32	1.32	53
1985-86	351003	74190	165	2126	1.22	1.22	1.22	54
1986-87	354977	84130	169	2097	1.05	1.05	1.05	53
1987-88	368726	111760	173	2128	0.97	0.97	0.97	56
1988-89	427621	124260	176	2425	0.86	0.86	0.86	60
1989-90	463500	113982	179	2586	0.89	0.89	0.89	64
1990-91	492070	117250	184	2680	0.95	0.95	0.95	67
1991-92	473890	173511	188	2526	0.95	0.95	0.95	71
1992-93	555510	164921	191	2903	0.92	0.92	0.92	72
1993-94	588100	192226	195	3014	0.84	0.84	0.84	75
1994-95	640570	203585	199	3221	0.86	0.86	0.86	80
1995-96	678060	236880	202	3349	0.92	0.92	0.92	91
1996-97	845549	288574	206	4098	0.90	0.90	0.90	96
1997-98	1047689	353792	209	3704	0.83	0.83	0.83	102
1998-99	1107127	433749	212	3860	0.83	0.83	0.79	112
1999-2000	1169937	531776	215	4024	0.84	0.83	0.78	110
2000-01	1236311	651957	218	4194	0.85	0.83	0.78	
2001-02	1306450	799299	223	4340	0.86	0.83	0.78	
2002-03	1380568	979941	226	4524	0.87	0.83	0.77	
2003-04	1458891	1201408	229	4715	0.88	0.83	0.77	

YEARS	NSDP (millions)	DEXP (millions)	POP (millions)	PCY (Rs)	PRGRO	PRCONST	PRFIT	PCC (kg)
2004-05	1541658	1472926	232	4914	0.89	0.83	0.77	
2005-06	1629120	1805807	235	5121	0.89	0.83	0.76	
2006-07	1721544	2213919	239	5337	0.90	0.83	0.76	
2007-08	1819212	2714265	242	5569	0.91	0.83	0.76	
2008-09	1922421	3327689	245	5811	0.92	0.83	0.76	
2009-10	2031485	4079746	248	6064	0.93	0.83	0.75	
2010-11	2146736	5001769	251	6328	0.94	0.83	0.75	
2011-12	2268526	6132169	254	6600	0.95	0.83	0.75	
2012-13	2397225	7518039	257	6894	0.96	0.83	0.74	
2013-14	2533226	9217116	260	7201	0.97	0.83	0.74	
2014-15	2676942	11300184	263	7522	0.98	0.83	0.74	
2015-16	2828812	13854025	266	7857	0.99	0.83	0.73	
2016-17	2989298	16985035	269	8204	1.00	0.83	0.73	
2017-18	3158889	20823653	272	8585	1.01	0.83	0.73	
2018-19	3338100	25529799	275	8984	1.02	0.83	0.73	
2019-20	3527479	31299533	277	9401	1.03	0.83	0.72	
2020-21	3727602	38373228	283	9740	1.04	0.83	0.72	

Table 31 Input data for cement demand forecast (East _high)

Years	NSDP (millions)	DEXP (millions)	POP (millions)	PCC (kg)	PCY (Rs)	PRCONST	PRFIT	PRGRO
1970-71	144863	1112	122	19	1189	1.04	1.04	1.04
1971-72	146959	1265	124	17	1172	1.04	1.04	1.04
1972-73	147485	1376	126	19	1164	0.93	0.93	0.93
1973-74	150935	1546	129	18	1143	0.84	0.84	0.84
1974-75	151851	1790	132	17	1146	0.88	0.88	0.88
1975-76	165134	2150	135	20	1129	1.03	1.03	1.03
1976-77	168166	2639	137	21	1203	1.02	1.02	1.02
1977-78	182850	3019	140	20	1200	0.99	0.99	0.99
1978-79	184834	3865	143	21	1276	1.10	1.10	1.10
1979-80	173475	3914	146	20	1263	1.10	1.10	1.10
1980-81	193860	11628	150	20	1160	0.95	0.95	0.95
1981-82	194760	14736	153	22	1268	1.00	1.00	1.00
1982-83	197020	33983	156	22	1249	1.19	1.19	1.19
1983-84	221640	35860	159	24	1237	1.28	1.28	1.28
1984-85	229620	43390	163	25	1363	1.32	1.32	1.32
1985-86	240310	48110	166	26	1383	1.22	1.22	1.22
1986-87	252060	55690	170	28	1417	1.05	1.05	1.05
1987-88	252290	67640	173	31	1456	0.97	0.97	0.97
1988-89	276940	61190	177	34	1427	0.86	0.86	0.86
1989-90	283340	67928	181	32	1532	0.89	0.89	0.89
1990-91	290560	68043	185	33	1535	0.95	0.95	0.95
1991-92	301600	87858	188	35	1543	0.95	0.95	0.95
1992-93	299680	96889	192	32	1570	0.92	0.92	0.92
1993-94	316650	111698	196	32	1530	0.84	0.84	0.84
1994-95	338570	119493	200	34	1586	0.86	0.86	0.86

Years	NSDP (millions)	DEXP (millions)	POP (millions)	PCC (kg)	PCY (Rs)	PRCONST	PRFIT	PRGRO
1995-96	348540	132971	203	36	1664	0.92	0.92	0.92
1996-97	369100	150066	207	39	1683	0.90	0.90	0.90
1997-98	254725	183831	209	42	1923	0.83	0.83	0.83
1998-99	268910	225193	212	42	2009	0.83	0.93	0.83
1999-2000	283886	275861	214		2098	0.83	0.92	0.84
2000-01	299696	337930	216		2191	0.83	0.92	0.85
2001-02	316386	413964	219		2282	0.83	0.91	0.86
2002-03	334005	507106	222		2376	0.83	0.91	0.87
2003-04	352606	621205	225		2475	0.83	0.90	0.88
2004-05	372242	760977	228		2578	0.83	0.90	0.89
2005-06	392973	932196	231		2685	0.83	0.89	0.89
2006-07	414857	1141941	234		2798	0.83	0.89	0.90
2007-08	437961	1398877	238		2915	0.83	0.89	0.91
2008-09	462351	1713624	241		3037	0.83	0.88	0.92
2009-10	488099	2099190	244		3165	0.83	0.88	0.93
2010-11	515281	2571508	247		3297	0.83	0.87	0.94
2011-12	543977	3150097	250		3439	0.83	0.87	0.95
2012-13	574271	3858869	253		3587	0.83	0.86	0.96
2013-14	606252	4727114	256		3741	0.83	0.86	0.97
2014-15	640015	5790715	259		3902	0.83	0.85	0.98
2015-16	675657	7093626	263		4069	0.83	0.85	0.99
2016-17	713284	8689692	265		4254	0.83	0.84	1.00
2017-18	753007	10644872	268		4447	0.83	0.84	1.01
2018-19	794942	13039969	270		4648	0.83	0.83	1.02
2019-20	839212	15973962	273		4859	0.83	0.83	1.03
2020-21	885948	19568103	276		5080	0.83	0.82	1.04

Table 32 Input data for cement demand forecast (East_medium)

Years	NSDP (millions)	DEXP (millions)	POP (millions)	PCC (kg)	PCY (Rs)	PRCONST	PRFIT	PR GRO
1970-71	144863	1112	122	18.55	1188	1.04	1.04	1.04
1971-72	146959	1265	124	17.44	1188	1.04	1.04	1.04
1972-73	147485	1376	126	18.61	1168	0.93	0.93	0.93
1973-74	150935	1546	129	17.84	1170	0.84	0.84	0.84
1974-75	151851	1790	132	17.07	1153	0.88	0.88	0.88
1975-76	165134	2150	135	19.64	1227	1.03	1.03	1.03
1976-77	168166	2639	137	21.35	1225	1.02	1.02	1.02
1977-78	182850	3019	140	20.38	1305	0.99	0.99	0.99
1978-79	184834	3865	143	20.62	1289	1.10	1.10	1.10
1979-80	173475	3914	146	19.73	1185	1.10	1.10	1.10
1980-81	193860	11628	150	20.22	1296	0.95	0.95	0.95
1981-82	194760	14736	153	21.73	1274	1.00	1.00	1.00
1982-83	197020	33983	156	22.04	1263	1.19	1.19	1.19
1983-84	221640	35860	159	24.47	1392	1.28	1.28	1.28
1984-85	229620	43390	163	24.84	1413	1.32	1.32	1.32
1985-86	240310	48110	166	25.71	1447	1.22	1.22	1.22

Years	NSDP (millions)	DEXP (millions)	POP (millions)	PCC (kg)	PCY (Rs)	PRCONST	PRFIT	PR GRO
1986-87	252060	55690	170	28.27	1487	1.05	1.05	1.05
1987-88	252290	67640	173	31.48	1457	0.97	0.97	0.97
1988-89	276940	61190	177	34.00	1566	0.86	0.86	0.86
1989-90	283340	67928	181	31.92	1568	0.89	0.89	0 89
1990-91	290560	68043	185	33.33	1574	0.95	0.95	0.95
1991-92	301600	87858	188	35.25	1601	0.95	0.95	0 95
1992-93	299680	96889	192	32.37	1560	0.92	0.92	0.92
1993-94	316650	111698	196	32.30	1617	0.84	0.84	0.84
1994-95	338570	119493	200	33.57	1696	0.86	0.86	0.86
1995-96	348540	132971	203	35.66	1713	0.92	0.92	0.92
1996-97	369100	150066	207	39.48	1782	0.90	0.90	0.90
1997-98	252816	183831	209	41.65	1909	0.83	0.83	0.83
1998-99	264896	225193	212	42.021	1979	0.83	0.79	0.83
1999-2000	277552	275861	214		2051	0.83	0.78	0 84
2000-01	290814	337930	216		2126	0.83	0.78	0.85
2001-02	304709	413964	219		2197	0.83	0.78	0.86
2002-03	319267	507106	222		2272	0.83	0.77	0.87
2003-04	334522	621205	225		2348	0.83	0.77	0.88
2004-05	350505	760977	228		2427	0.83	0.77	0.89
2005-06	367252	932196	231		2509	0.83	0.76	0.89
2006-07	384800	1141941	234		2595	0.83	0.76	0.90
2007-08	403185	1398877	238		2683	0.83	0.76	0.91
2008-09	422449	1713624	241		2775	0.83	0.76	0.92
2009-10	442634	2099190	244		2870	0.83	0.75	0.93
2010-11	463783	2571508	247		2968	0.83	0.75	0.94
2011-12	485942	3150097	250		3072	0.83	0.75	0.95
2012-13	509160	3858869	253		3180	0.83	0.74	0.96
2013-14	533488	4727114	256		3292	0.83	0.74	0.97
2014-15	558978	5790715	259		3408	0.83	0.74	0 98
2015-16	585686	7093626	263		3527	0.83	0.73	0.99
2016-17	613670	8689692	265		3660	0.83	0.73	1.00
2017-18	642991	10644872	268		3797	0.83	0.73	1 01
2018-19	673712	13039969	270		3939	0.83	0.73	1.02
2019-20	705902	15973962	273		4087	0.83	0.72	1.03
2020-21	739630	19568103	276		4241	0.83	0.72	1.04

Table 33 Input data for cement demand forecast (East_low)

Years	NSDP (millions)	POP (millions)	PCC (kg)	PCY (Rs)	PRFIT	PRGRO	PCONST	DEXP(millions)
1970-71	144863	122	19	1188	1.04	1.04	1.04	1112
1971-72	146959	124	17	1189	1.04	1.04	1.04	1265
1972-73	147485	126	19	1168	0.93	0.93	0.93	1376
1973-74	150935	129	18	1170	0.84	0.84	0.84	1546
1974-75	151851	132	17	1153	0.88	0.88	0.88	1790
1975-76	165134	135	20	1227	1.03	1.03	1.03	2150
1976-77	168166	137	21	1225	1.02	1.02	1.02	2639

Years	NSDP (millions)	POP (millions)	PCC (kg)	PCY (Rs)	PRFIT	PRGRO	PCONST	DEXP(millions)
1977-78	182850	140	20	1305	0.99	0.99	0.99	3019
1978-79	184834	143	21	1289	1.10	1.10	1.10	3865
1979-80	173475	146	20	1185	1.10	1.10	1.10	3914
1980-81	193860	150	20	1296	0.95	0.95	0.95	11628
1981-82	194760	153	22	1274	1.00	1.00	1 00	14736
1982-83	197020	156	22	1263	1.19	1.19	1 19	33983
1983-84	221640	159	24	1392	1.28	1.28	1.28	35860
1984-85	229620	163	25	1413	1.32	1.32	1.32	43390
1985-86	240310	166	26	1447	1.22	1.22	1 22	48110
1986-87	252060	170	28	1487	1.05	1.05	1.05	55690
1987-88	252290	173	31	1457	0.97	0.97	0.97	67640
1988-89	276940	177	34	1566	0.86	0.86	0.86	61190
1989-90	283340	181	32	1568	0.89	0.89	0.89	67928
1990-91	290560	185	33	1574	0.95	0.95	0.95	68043
1991-92	301600	188	35	1601	0.95	0.95	0.95	87858
1992-93	299680	192	32	1560	0.92	0.92	0.92	96889
1993-94	316650	196	32	1617	0.84	0.84	0.84	111698
1994-95	338570	200	34	1696	0.86	0.86	0.86	119493
1995-96	348540	203	36	1713	0.92	0.92	0.92	132971
1996-97	369100	207	39	1782	0.90	0.90	0.90	150066
1997-98	252816	209	42	1909	0.83	0.83	0.83	183831
1998-99	264896	212	42	1979	0.79	0.83	0.83	225193
1999-2000	275453	214		2035	0.78	0.84	0.83	275861
2000-01	286431	216		2094	0.78	0.85	0.83	337930
2001-02	297846	219		2148	0.78	0.86	0.83	413964
2002-03	309717	222		2204	0.77	0.87	0.83	507106
2003-04	322061	225		2261	0.77	0.88	0.83	621205
2004-05	334896	228		2319	0.77	0.89	0.83	760977
2005-06	348243	231		2379	0.76	0.89	0.83	932196
2006-07	362123	234		2442	0.76	0.90	0.83	1141941
2007-08	376555	238		2506	0.76	0.91	0.83	1398877
2008-09	391562	241		2572	0.76	0.92	0.83	1713624
2009-10	407168	244		2640	0.75	0.93	0.83	2099190
2010-11	423395	247		2709	0.75	0.94	0.83	2571508
2011-12	440270	250		2783	0.75	0.95	0.83	3150097
2012-13	457816	253		2859	0.74	0.96	0.83	3858869
2013-14	476063	256		2937	0.74	0.97	0.83	4727114
2014-15	495036	259		3018	0.74	0.98	0.83	5790715
2015-16	514765	263		3100	0.73	0.99	0.83	7093626
2016-17	535281	265		3192	0.73	1.00	0.83	8689692
2017-18	556615	268		3287	0.73	1.01	0.83	10644872
2018-19	578798	270		3384	0.73	1.02	0.83	13039969
2019-20	601866	273		3485	0.72	1.03	0.83	15973962
2020-21	625853	276		3588	0.72	1.04	0.83	19568103

Annexure 2.5 Bricks

High growth scenario (7%pa GDP growth)

Table 1 Demand for bricks and corresponding coal demand

	Bricks (billion)	Coal (MT)
1999/2000	110.00	19.80
2000/01	116.93	21.05
2001/02	124.56	22.42
2002/03	132.60	22.54
2003/04	140.94	23.96
2004/05	149.70	25.45
2005/06	159.10	23.87
2006/07	169.22	25.38
2011/12	229.95	34.49
2016/17	312.47	46.87
2020/21	399.33	59.90

Medium growth scenario (5% pa GDP growth)

Table 2 Demand for bricks and related coal demand (Low)

	Bricks (billion)	Coal (MT)
1999/2000	110.00	19.80
2000/01	116.02	20.88
2001/02	122.58	22.06
2002/03	129.38	22.00
2003/04	136.34	23.18
2004/05	143.62	24.41
2005/06	151.39	22.71
2006/07	159.70	23.96
2011/12	208.15	31.22
2016/17	271.29	40.69
2020/21	335.33	50.30

Low growth scenario (5% pa GDP growth)

Table 3 Demand for bricks and related coal demand (Low)

	Bricks (billion)	Coal (MT)
1999/2000	110.00	19.80
2000/01	115.94	20.87
2001/02	122.46	22.04
2002/03	129.26	21.97
2003/04	136.22	23.16
2004/05	143.47	24.39
2005/06	151.18	22.68
2006/07	159.43	23.92
2011/12	207.63	31.15
2016/17	270.39	40.56
2020/21	333.99	50.10

Table 4 Input data for bricks demand forecast (high growth)

Years	GDPcon (millions)	GDP (millions)
1970-71	4538	90426
1971-72	4558	91339
1972-73	4665	91048
1973-74	4362	95192
1974-75	4223	96297
1975-76	4825	104968
1976-77	5297	106280
1977-78	5833	114219
1978-79	5703	120504
1979-80	5402	114236
1980-81	6114	122427
1981-82	6446	129889
1982-83	6148	133915
1983-84	6576	144865
1984-85	6828	150433
1985-86	7183	156566
1986-87	7537	163271
1987-88	7777	170322
1988-89	8379	188461
1989-90	8807	201453
1990-91	9462	212253
1991-92	9741	213983
1992-93	10190	225240
1993-94	10608	239145
1994-95	11261	257700
1995-96	12032	276132
1996-97	12940	296845
1997-98	13789	317624
1998-99	14617	339858
1999-00	15491	363648
2000-01	16467	389103
2001-02	17541	416340
2002-03	18674	445484
2003-04	19848	476668
2004-05	21082	510035
2005-06	22405	545737
2006-07	23830	583939
2007-08	25349	624815
2008-09	26954	668552
2009-10	28651	715350
2010-11	30457	765425
2011-12	32383	819005
2012-13	34435	876335
2013-14	36615	937679

Years	GDPcon (millions)	GDP (millions)
2014-15	38929	1003316
2015-16	41387	1073548
2016-17	44003	1148696
2017-18	46787	1229105
2018-19	49747	1315143
2019-20	52892	1407203
2020-21	56235	1505707

Table 5 Input data for bricks demand forecast (medium growth)

Years	GDPcon (millions)	GDP_med (millions)
1970-71	4538	90426
1971-72	4558	91339
1972-73	4665	91048
1973-74	4362	95192
1974-75	4223	96297
1975-76	4825	104968
1976-77	5297	106280
1977-78	5833	114219
1978-79	5703	120504
1979-80	5402	114236
1980-81	6114	122427
1981-82	6446	129889
1982-83	6148	133915
1983-84	6576	144865
1984-85	6828	150433
1985-86	7183	156566
1986-87	7537	163271
1987-88	7777	170322
1988-89	8379	188461
1989-90	8807	201453
1990-91	9493	212253
1991-92	9785	213983
1992-93	10223	225240
1993-94	10629	239145
1994-95	11290	257700
1995-96	12080	276132
1996-97	12998	296845
1997-98	13726	314656
1998-99	14422	333535
1999-00	15160	353547
2000-01	15989	374760
2001-02	16893	397246
2002-03	17831	421080
2003-04	18790	446345
2004-05	19793	473126

Years	GDPcon (millions)	GDP_med (millions)
2005-06	20865	501513
2006-07	22010	531604
2007-08	23217	563500
2008-09	24479	597310
2009-10	25804	633149
2010-11	27204	671138
2011-12	28686	711406
2012-13	30251	754091
2013-14	31898	799336
2014-15	33631	847296
2015-16	35459	898134
2016-17	37388	952022
2017-18	39423	1009143
2018-19	41569	1069692
2019-20	43830	1133874
2020-21	46214	1201906

Table 6 Input data for bricks demand forecast (low growth)

Years	GDPcon (millions)	GDP (millions)
1970-71	4538	90426
1971-72	4558	91339
1972-73	4665	91048
1973-74	4362	95192
1974-75	4223	96297
1975-76	4825	104968
1976-77	5297	106280
1977-78	5833	114219
1978-79	5703	120504
1979-80	5402	114236
1980-81	6114	122427
1981-82	6446	129889
1982-83	6148	133915
1983-84	6576	144865
1984-85	6828	150433
1985-86	7183	156566
1986-87	7537	163271
1987-88	7777	170322
1988-89	8379	188461
1989-90	8807	201453
1990-91	9462	212253
1991-92	9741	213983
1992-93	10190	225240
1993-94	10608	239145
1994-95	11261	257700
1995-96	12032	276132

Years	GDPcon (millions)	GDP (millions)
1996-97	12940	296845
1997-98	13672	311687
1998-99	14370	327272
1999-00	15100	343635
2000-01	15916	360817
2001-02	16810	378858
2002-03	17744	397801
2003-04	18700	417691
2004-05	19694	438575

Annexure 3.1

```
* Model name COLPLAN last modified 5 March 2001
* This model is written for the CIL study on
* "Coal in India's Future Energy scene"
* "The COLPLAN model has been adapted from the COLINK model
*  Some equations and variables in this code may therefore not be relevant

* ----------
*   SETS
* ----------

*******************************************************
*   fn & pn  include all the coalfields & ports in India
*******************************************************
Set fn coalfield node
/
$include coalfld.dat
/;

Set port (fn) port node for coal importing
/
$include port.dat
/;

*******************************************************
*    plants.dat is called into the source code     *
*    to include all the thermal plants in India     *
*                                    *
*    plantsNR, plantsWR, plantsSR, plantsER, plantsNE  *
*    are called into the program to include sets of *
*    plants in the North, East, South, West & North *
*    East respectively.                  *
*    Each of the above 5 sets are subsets of the   *
*    set plants (that includes all thermal plants  *
*    in India)                       *
*******************************************************
Set pn plant nodes
```

```
/
$include plants.dat
/;

Set NR (pn) subset of plants in Northern Region
/
$include plantsNR.dat
/;

Set WR (pn) subset of plants in Western Region
/
$include plantsWR.dat
/;

Set SR (pn) subset of plants in Southern Region
/
$include plantsSR.dat
/;

Set ER (pn) subset of plants in Eastern Region
/
$include plantsER.dat
/;

Set NE (pn) subset of plants in North-eastern Region
/
$include plantsNE.dat
/;

*******************************************************
*    include option for washeries at all fields
*******************************************************
*Set wn washery node
*/
*$include washery.dat
*/;
```

```
********************************************************
*    include all grades of non coking coal      *
********************************************************
Set gcol nomenclature of coal grade
/
$include gcol.dat
/;

Set tch technology of plant
/
$include tch.dat
/;

alias (NR,NR1);
alias (ER,ER1);
alias (WR,WR1);
alias (SR,SR1);
alias (NE,NE1);


*  ---------------
*    Parameters
*  ---------------

* ============================
*  Coalfield characteristics
* ============================

********************************************************
*    capacity of coalfield for each coalgrade     *
********************************************************
Table colpdc(fn,gcol) current amount production of coal in Mt per year
$ondelim
$include colpdc.csv
$offdelim;

Parameter capfld(fn,gcol) capacity of annual coal production in Mt;
capfld(fn,gcol) = colpdc(fn,gcol);
```

```
* ==============================
*  Coal characteristics
* ==============================

***********************************************************
*     include the gross calorific value of coal at   *
*     each coalfield                          *
*     The GCV is in kcal/kg or Mcal/tons *
***********************************************************
Table calval(fn,gcol) calorific value of coal in Gcal per 10^3 ton
$ondelim
$include calval.csv
$offdelim

Table ashp(fn,gcol) ash content of coal in %
$ondelim
$include ashp.csv
$offdelim

Table moistp(fn,gcol) moisture content of coal in %
$ondelim
$include moistp.csv
$offdelim


***********************************************************
*     include the price of coal at each coalfield in Rs/ton    *
***********************************************************
Table colprice(fn,gcol) pithead price of coal for each grade in Rs
$ondelim
$include colprice.csv
$offdelim

* ==========================:
*  Powerplant characteristics
* ==========================:

*Parameter
```

```
*$include pnutlash.dat

Parameter avgashp(pn) average ash contents at each powerplant in BAU in %
/
$include avgashp.dat
/;

Table pcostfix(pn,tch) investment cost of power plants in Rs per MW
$ondelim
$include pcostfix.csv
$offdelim

Table hrateorg(pn,tch) original heat rate of power plants in Gcal per GWh
$ondelim
$include heatrate.csv
$offdelim

Table plfpoworg(pn,tch) PLF of power plants in %
$ondelim
$include plfpow.csv
$offdelim

Parameter hrate(fn,pn,tch,gcol) heat rate of power plants for each coal in Gcal
per GWh;

**********************************************************
*     The capacity of the existing plant is provided in MW   *
**********************************************************
Table cappowlo(pn,tch) existing capacity of power plant in MW
$ondelim
$include cappowlo.csv
$offdelim


* ==========================
*  Railway Characteristics
* ==========================
Table
faref2p(fn,pn) railway fare from coalfield to powplant in Rs per ton
$ondelim
$include faref2p.csv
$offdelim;


Table distrwf2p(fn,pn) railway distance from coalfld to powplant in km
$ondelim
$include distrwf2p.csv
$offdelim


Table cltrnslo(fn,pn) lower bound of coal movement from coalfld to powplant in
Mt
$ondelim
$include cltrnslo.csv
$offdelim

Table cltrnsup(fn,pn) upper bound of coal movement from coalfld to powplant
in Mt
$ondelim
$include cltrnsup.csv
$offdelim


* ============================
*  Power Demand
* ============================

********************************************************
*     include the power demand at each powerplant    *
********************************************************
Parameter demandNR(NR) power demand at powplant in NR in GWh
/
$include demandNR.dat
/;
Parameter demandWR(WR) power demand at powplant in WR in GWh
```

```
/
$include demandWR.dat
/;
Parameter demandSR(SR) power demand at powplant in SR in GWh
/
$include demandSR.dat
/;
Parameter demandER(ER) power demand at powplant in ER in GWh
/
$include demandER.dat
/;
Parameter demandNE(NE) power demand at powplant in NE in GWh
/
$include demandNE.dat
/;


* ==============================
*  etc...
* ==============================

Scalar powprfash production rate of fly ash from power plant in Mt per Mt
/ 0.80 /;

Scalar ESPefc  efficiency of ESP at powerplant
/ 0.95 /;

Scalar CO2prod         CO2 emission productivity by coal consumption in Million
ToC per 10^13kcal
/ 1.0344 /

*  --------------
*    Variables
*  --------------

Variables
* ==============================
* Coalfield
* ==============================

qtymined(fn,gcol) gradewise extraction from each coalfield in Mt

* ==============================
*  Coal Transportation
* ==============================

qtyf2w(fn,gcol) gradewise quantity shipped from coalfield to washery in Mt
qtyf2p(fn,pn,tch,gcol) gradewise quantity shipped from coalfield to plant in Mt
qtyw2p(fn,pn,tch,gcol) gradewise quantity shipped from washery to plant in Mt

* ==============================
*  Powerplant
* ==============================

Variables
uheatatp(pn,tch) useful energy required at plant in Gcal
cappow(pn,tch) capacity of plant in MW
powgen(pn,tch) power output from each plant in GWh

qtyashpow(pn) quantity of ash produced at powerplant in Mt
qtybashpow(pn) quantity of bottom ash produced of coal in Mt
qtyfashpow(pn) quantity of fly ash produced from coal in Mt;


* ==============================
*  Power T&D
* ==============================

Variables
transNR(NR,NR1) transmission between nodes in the Northern region in GWh
transWR(WR,WR1) transmission between nodes in the Western region in GWh
transSR(SR,SR1) transmission between nodes in the Southern region in GWh
transER(ER,ER1) transmission between nodes in the Eastern Region in GWh
transNE(NE,NE1) transmission between nodes in the North-Eastern region in
GWh
```

```
* ==============================
* Emissions
* ==============================

spm(pn) spm emissions in Mt at each pn
totspm total spm in Mt
sox(pn) sox emissions in Mt at each pn
totsox total sox all India in Mt
nox(pn) nox emissions in Mt at each pn
totnox total nox in Mt

co2(pn) CO2 emissions in Mt at each pn
totco2 total co2 in Mt
* ==============================
* Total system cost
* ==============================
*****************************************************************
*     system cost consists of pithead price of coal and    *
*     railway fare, investment and operation cost of       *
*     powerplants                                          *
*****************************************************************
z total system cost;


* Variable types

Free variable z ;
Positive variables
qtymined,qtyf2w,capwsh,qtyashwsh,qtybashpow,qtyfashpow,qtyf2p,qtyw2p,
transNR,transWR,transSR,transER,transNE,cappow,uheatatp,powgen,grwrtiofl
d,spm,sox,nox,totsox,totnox;


*   ------------
*   EQUATIONS
*   ------------
* ===============================
*  Coalfield
* ===============================

****************************************************************
* the quantity that is mined must go to the power plants   *
****************************************************************

Equation
minebal(fn,gcol) production balance equal qty shipped to plants;
minebal(fn,gcol).. qtymined(fn,gcol) =e=
sum((pn,tch),qtyf2p(fn,pn,tch,gcol))+qtyf2w(fn,gcol);



* ===============================
*  Powerplant
* ===============================
****************************************************************
* useful heat requirement at each plant in Gcal             *
****************************************************************
*Equation
*uheat(pn,tch) useful heat required at each plant in Gcal;
*uheat(pn,tch).. uheatatp(pn,tch) =e= powgen(pn,tch)*heatrate(pn,tch);

****************************************************************
* equate useful energy rqd at plant(Gcal)with coal need(Mt)   *
****************************************************************
*Equation
*coalneed(pn,tch) power generation balance at each power unit;
*coalneed(pn,tch).. uheatatp(pn,tch) =e= sum((fn,gcol),
(qtyf2p(fn,pn,tch,gcol)*10**3)*calval(fn,gcol)) +
sum((fn,gcol),(qtyw2p(fn,pn,tch,gcol)*10**3)*calvalw(fn,gcol));

****************************************************************
* power output                              *
****************************************************************
*Equation
*cappower(pn,tch) plant capacity constraint for existing units;
*cappower(pn,tch).. powgen(pn,tch)*10**3 =l=
* cappow(pn,tch)*(plfpow(pn,tch)/100)*8760;

Equation
powgeneq(pn,tch) power generation balance at each power unit;
powgeneq(pn,tch).. powgen(pn,tch) =e=
sum((fn,gcol),(qtyf2p(fn,pn,tch,gcol)*10**3)*calval(fn,gcol)/hrate(fn,pn,tch,gco
l)) +
sum((fn,gcol),(qtyw2p(fn,pn,tch,gcol)*10**3)*calvalw(fn,gcol)/hratew(fn,pn,tch
,gcol));


Equation
powopreq(pn,tch) powerplant operation balance at each power unit;
powopreq(pn,tch).. cappow(pn,tch)*8760/1000 =g=
sum((fn,gcol),(qtyf2p(fn,pn,tch,gcol)*10**3)*calval(fn,gcol)/hrate(fn,pn,tch,gco
l)*(100/plfpow(fn,pn,tch,gcol))) +
sum((fn,gcol),(qtyw2p(fn,pn,tch,gcol)*10**3)*calvalw(fn,gcol)/hratew(fn,pn,tch
,gcol)*(100/plfpoww(fn,pn,tch,gcol)));


Equation
cappowold(pn,tch) plant capacity constraint for existing units;
cappowold(pn,tch).. cappow(pn,tch) =g= cappowlo(pn,tch);

*Equation
*uppercap(pn,tch) upper bound on capacity of unit in MW;
*uppercap(pn,tch).. cappow(pn,tch) =l= cappowup(pn,tch);

*********************************************************************
* fly-ash balance at power plants                              *
*********************************************************************
Equations
powashbal(pn) ash at plant equals product sum of ash rate and coal burnt
powfashbal(pn) fly ash at powerplant balance;

powashbal(pn).. qtyashpow(pn) =e= sum((fn,gcol,tch),
qtyf2p(fn,pn,tch,gcol)*ashp(fn,gcol)/100) +
sum((fn,tch,gcol),qtyw2p(fn,pn,tch,gcol)*ashpw(fn,gcol)/100);
```

```
powfashbal(pn).. qtyfashpow(pn) =e= qtyashpow(pn)*powprfash;


****************************************************************
* power I-O balance at each power unit in each region        *
****************************************************************
Equations
powbalNR(NR) generated and net transmitted power in NR not less than power
demand
powbalWR(WR) generated and net transmitted power in WR not less than
power demand
powbalSR(SR) generated and net transmitted power in SR not less than power
demand
powbalER(ER) generated and net transmitted power in ER not less than power
demand
powbalNE(NE) generated and net transmitted power in NE not less than power
demand;

powbalNR(NR).. demandNR(NR) =l= sum((tch),powgen(NR,tch)) +
sum((NR1), (1-tdlossNR(NR1,NR))*transNR(NR1,NR) - transNR(NR,NR1));
powbalWR(WR).. demandWR(WR) =l= sum((tch),powgen(WR,tch)) +
sum((WR1), (1-tdlossWR(WR1,WR))*transWR(WR1,WR) -
transWR(WR,WR1));
powbalSR(SR).. demandSR(SR) =l= sum((tch),powgen(SR,tch)) + sum((SR1),
(1-tdlossSR(SR1,SR))*transSR(SR1,SR) - transSR(SR,SR1));
powbalER(ER).. demandER(ER) =l= sum((tch),powgen(ER,tch)) + sum((ER1),
(1-tdlossER(ER1,ER))*transER(ER1,ER) - transER(ER,ER1));
powbalNE(NE).. demandNE(NE) =l= sum((tch),powgen(NE,tch)) + sum((NE1),
(1-tdlossNE(NE1,NE))*transNE(NE1,NE) - transNE(NE,NE1));

* ============================
* Emissions
* ============================

****************************************************************
* Calculate various emissions                          *
****************************************************************
```

```
Equations
spmemit(pn) SPM balance equation
spmtotal total SPM emitted;

spmemit(pn).. spm(pn) =e= (1-ESPefc)*qtyfashpow(pn);
spmtotal.. totspm =e= sum((pn),spm(pn));

Equations
co2emit(pn) CO2 emission balance equation
co2total total CO2 emitted;

co2emit(pn).. co2(pn) =e= co2prod/(10**13)*(sum((fn,tch,gcol),
qtyf2p(fn,pn,tch,gcol)*(10**9)*calval(fn,gcol)) + sum((fn,tch,gcol),
qtyw2p(fn,pn,tch,gcol)*(10**9)*calvalw(fn,gcol)));
co2total.. totco2 =e= sum((pn), co2(pn));

* =============================
*  Total System Cost
* =============================

Equation
costsys system cost to be minimized in Rs;
costsys.. z =e= sum((fn,pn,tch,gcol),
            (qtyf2p(fn,pn,tch,gcol)*10**6)*faref2p(fn,pn)*iflrate)+
         sum((fn,pn,tch,gcol),
            (qtyw2p(fn,pn,tch,gcol)*10**6)*faref2p(fn,pn)*iflrate*dscrtwsh)+
         sum((fn,gcol),colprice(fn,gcol)*(qtymined(fn,gcol)*10**6))+
         sum((pn,tch),cappow(pn,tch)*pcostfix(pn,tch))+

         sum((pn),(qtyashpow(pn)-spm(pn))*ashdspcost*10**6)+

         sum((fn),capwsh(fn)*wcostfix(fn)*sawshbec)+

         sum((NR,NR1),tdcost*disttdNR(NR,NR1)*transNR(NR,NR1))+
         sum((WR,WR1),tdcost*disttdWR(WR,WR1)*transWR(WR,WR1))+
         sum((SR,SR1),tdcost*disttdSR(SR,SR1)*transSR(SR,SR1))+
         sum((ER,ER1),tdcost*disttdER(ER,ER1)*transER(ER,ER1))+
         sum((NE,NE1),tdcost*disttdNE(NE,NE1)*transNE(NE,NE1));
```

```
* ==============================
*  Scenarios
* ==============================

** In this file, there are several programs which model various scenarios.
** You can choose the options by putting or removing '*' at the first column of
** each line.

$include scenario.gms



* ----------------------------------------------------
*   for execution
* ----------------------------------------------------

Model Coal /all/;
Coal.workspace=80;
option lp=osl;
option iterlim=1000000;
option reslim=360000.0;
options solprint=off;

solve Coal using lp minimizing z;

* ----------------------------------------------------
*  Output in Display and Files
* ----------------------------------------------------

*display uheatatp.l ;
display cappow.l ;
display powgen.l ;
display qtymined.l ;
display qtyf2p.l ;
display qtyf2w.l ;
display qtyw2p.l ;
display capwsh.l ;
display transNR.l ;
display transWR.l ;
display transSR.l ;
display transER.l ;
display transNE.l ;
display qtyfashpow.l ;
display spm.l ;
display totspm.l ;
display wshcfcol ;

$include outfiles.gms



** Scenario options can be chosen from the following commands.
** Options to be chosen should not be asterisked - put or remove'*' at the first
** column of each line to change scenarios.

* ==============================
*  coal linkage
* ==============================

* uncomment this line for free linkage scenario
*$goto SKIPLINK

Table linkage(fn,pn)  possibility of coal transportation by railway
$ondelim
$include linkage.csv
$offdelim ;

loop((fn,pn,tch,gcol),
  if((linkage(fn,pn) eq 0),
    qtyf2p.fx(fn,pn,tch,gcol) = 0;
    qtyw2p.fx(fn,pn,tch,gcol) = 0;
    ));

$label SKIPLINK

* ==============================
*  washery capacity
* ==============================
* upper capacity of washery
*capwsh.up(fn) = 2.5;

* for no-washery scenario
capwsh.fx(fn) = 0;

* ==============================
*  coal linkage
* ==============================

* uncomment this line for free linkage scenario
*$goto SKIPLINK

Table linkage(fn,pn)  possibility of coal transportation by railway
$ondelim
$include linkage.csv
$offdelim ;

loop((fn,pn,tch,gcol),
  if((linkage(fn,pn) eq 0),
    qtyf2p.fx(fn,pn,tch,gcol) = 0;
    qtyw2p.fx(fn,pn,tch,gcol) = 0;
    ));

$label SKIPLINK

* ==============================
*  power transmission
* ==============================

*** upper bound of power transmission
transNR.fx(NR,NR1) = 0 ;
transWR.fx(WR,WR1) = 0 ;
transSR.fx(SR,SR1) = 0 ;
transER.fx(ER,ER1) = 0 ;
transNE.fx(NE,NE1) = 0 ;

*transNR.up(NR,NR1) = 2000000 ;
```

```
*transWR.up(WR,WR1) = 2000000 ;
*transSR.up(SR,SR1) = 2000000 ;
*transER.up(ER,ER1) = 2000000 ;
*transNE.up(NE,NE1) = 2000000 ;

* ==============================
*  POLICIES
* ==============================


*** POLICY low ash at powplant ***
*Equation
*lowashatp(pn,tch) ash under 34% at powplant;
*lowashatp(pn,tch).. sum((fn,gcol),
qtyf2p(fn,pn,tch,gcol)*ashp(fn,gcol)+qtyw2p(fn,pn,tch,gcol)*ashpw(fn,gcol))
=l= 34 * sum((fn,gcol), qtyf2p(fn,pn,tch,gcol)+qtyw2p(fn,pn,tch,gcol));


*** POLICY low ash if long transportation ***
*loop((fn,pn,tch,gcol),
*   if((ashp(fn,gcol)>34) and (distrwf2p(fn,pn)>1000),
*      qtyf2p.fx(fn,pn,tch,gcol) = 0););

*** SPM emission restriction ***
*totspm.up = 2.692


* ==============================
*  coal production
* ==============================

* for 1998/99 scenario
Equation
mximpcol max supply of imported coal;
mximpcol.. sum((port), qtymined(port, 'IG')) =l= 6.51;
```

```
========================================================
==============
* Choice of coal via rail & sea with constraint on total production
*
========================================================
==============


Equation
mxprdtlA max production of A grade at talcher;
mxprdtlA.. qtymined('TLC','AG')+ qtymined('TLP','AG') =l= 0.53;

Equation
mxprdtlB max production of BC grade at talcher;
mxprdtlB.. qtymined('TLC','BG')+ qtymined('TLP','BG') =l= 0.54;

Equation
mxprdtlD max production of D grade at talcher;
mxprdtlD.. qtymined('TLC','DG')+ qtymined('TLP','DG') =l= 0.54;

Equation
mxprdtlE max production of E grade at talcher;
mxprdtlE.. qtymined('TLC','EG')+ qtymined('TLP','EG') =l= 13.705;

Equation
mxprdtlF max production of F grade at talcher;
mxprdtlF.. qtymined('TLC','FG')+ qtymined('TLP','FG') =l= 13.705;


Equation
mxprdjhA max production of A grade at jharia;
mxprdjhA.. qtymined('JHA','AG')+ qtymined('JHH','AG') =l= 0.83;

Equation
mxprdjhB max production of BC grade at jharia;
mxprdjhB.. qtymined('JHA','BG')+ qtymined('JHH','BG') =l= 3.47;

Equation
mxprdjhD max production of D grade at jharia;
```

```
mxprdjhD.. qtymined('JHA','DG')+ qtymined('JHH','DG') =l= 3.47;

Equation
mxprdjhE max production of E grade at jharia;
mxprdjhE.. qtymined('JHA','EG')+ qtymined('JHH','EG') =l= 1.7;

Equation
mxprdjhL max production of L grade at jharia;
mxprdjhL.. qtymined('JHA','LG')+ qtymined('JHH','LG') =l= 12.12;


Equation
mxprdrnA max production of A grade at raniganj;
mxprdrnA.. qtymined('RNJ','AG')+ qtymined('RNH','AG') =l= 7.615;

Equation
mxprdrnB max production of BC grade at raniganj;
mxprdrnB.. qtymined('RNJ','BG')+ qtymined('RNH','BG') =l= 7.615;

Equation
mxprdrnD max production of D grade at raniganj;
mxprdrnD.. qtymined('RNJ','DG')+ qtymined('RNH','DG') =l= 0.02;


Equation
mxprdibB max production of BC grade at ib;
mxprdibB.. qtymined('IBV','BG')+ qtymined('IBP','BG')+ qtymined('IBZ','BG')
=l= 0.6;

Equation
mxprdibD max production of D grade at ib;
mxprdibD.. qtymined('IBV','DG')+ qtymined('IBP','DG')+ qtymined('IBZ','DG')
=l= 0.6;

Equation
mxprdibE max production of E grade at ib;
mxprdibE.. qtymined('IBV','EG')+ qtymined('IBP','EG')+ qtymined('IBZ','EG')
=l= 6.645;
```

```
Equation
mxprdibF max production of F grade at ib;
mxprdibF.. qtymined('IBV','FG')+ qtymined('IBP','FG')+ qtymined('IBZ','FG')
=l= 6.645;

Equation
mxprdkrB max production of BC grade at korba;
mxprdkrB.. qtymined('KRB','BG')+ qtymined('KRP','BG')+
qtymined('KRV','BG') =l= 1.86;

Equation
mxprdkrD max production of D grade at korba;
mxprdkrD.. qtymined('KRB','DG')+ qtymined('KRP','DG')+
qtymined('KRV','DG') =l= 11.34;

Equation
mxprdkrE max production of E grade at korba;
mxprdkrE.. qtymined('KRB','EG')+ qtymined('KRP','EG')+
qtymined('KRV','EG') =l= 11.34;

Equation
mxprdkrF max production of F grade at korba;
mxprdkrF.. qtymined('KRB','FG')+ qtymined('KRP','FG')+ qtymined('KRV','FG')
=l= 11.33;

Equation
mxprdmrD max production of D grade at raigarh;
mxprdmrD.. qtymined('MRG','DG')+ qtymined('MRP','DG')+
qtymined('MRV','DG') =l= 0.31;

Equation
mxprdkwA max production of A grade at korearewa;
mxprdkwA.. qtymined('KRW','AG')+ qtymined('KWP','AG')+
qtymined('KWV','AG') =l= 3.465;

Equation
mxprdkwB max production of BC grade at korearewa;
```

```
mxprdkwB.. qtymined('KRW','BG')+ qtymined('KWP','BG')+
qtymined('KWV','BG') =l= 3.465;

Equation
mxprdkwD max production of D grade at korearewa;
mxprdkwD.. qtymined('KRW','DG')+ qtymined('KWP','DG')+
qtymined('KWV','DG') =l= 3.465;

Equation
mxprdkwE max production of E grade at korearewa;
mxprdkwE.. qtymined('KRW','EG')+ qtymined('KWP','EG')+
qtymined('KWV','EG') =l= 0.15;

Equation
mxprdkwL max production of L grade at korearewa;
mxprdkwL.. qtymined('KRW','LG')+ qtymined('KWP','LG')+
qtymined('KWV','LG') =l= 0.145;

* -------------------------
*  coal production
* -------------------------

* growth rate of coal production capacity
capfldgrt = 1.0;

Equation
mxsupcol(fn,gcol) fieldwise gradewise max supply constraint of coal;
mxsupcol(fn,gcol).. capfldgrt*colpdc(fn,gcol) =g= qtymined(fn,gcol);

*** constraint for production of A, B&C coal ***
*qtymined.up(fn,'AG') = 0;

*Equation
*maxBcol        maximum of B&C grade coal production;
*maxBcol.. sum((fn), qtymined(fn,'BG')) =l= 0.90*sum((fn), colpdc(fn,'BG'));

*qtymined.up(fn,'BG') = 0.78*colpdc(fn,'BG');
```

```
* -------------------------
*  powerplant capacity
* -------------------------


* for 1996/97 case
*cappow.fx(pn,tch) = cappowlo(pn,tch);

*cappow.up(pn,"SUPC") = 0;
*cappow.up(pn,"IGCC") = 0;

* -------------------------
*  railway transportation
* -------------------------

*** set lower bound of coal transportation (for captive mining?)
*Equation
*mincltrns(fn,pn);
*mincltrns(fn,pn).. cltrnslo(fn,pn) =l= sum((tch,gcol),qtyf2p(fn,pn,tch,gcol)) +
sum((tch,gcol), qtyw2p(fn,pn,tch,gcol));

*** set upper bound of coal transportation (for coal linkage?)
*Equation
*maxcltrns(fn,pn);
*maxcltrns(fn,pn).. cltrnsup(fn,pn) =g= sum((tch,gcol),qtyf2p(fn,pn,tch,gcol)) +
sum((tch,gcol), qtyw2p(fn,pn,tch,gcol));
```

Annexure 3.2

Regionwise list of power plants - ownership and location details

	Plant Name		Operator	Town	State	Region
1	Badarpur	BDRP	DESU	New Delhi	DELHI	NR
2	Inderprastha	INDP	DESU	New Delhi	DELHI	NR
3	Rajghat	RAJG	DESU	New Delhi	DELHI	NR
4	Faridabad	FRDB	HPGCL	Faridabad	HARYANA	NR
5	Panipat	PNPT	HPGCL	Panipat	HARYANA	NR
6	Bhatinda	BHTN	PSEB	Bhatinda	PUNJAB	NR
7	Lehra Mohabbat	LHMO	PSEB	Bhatinda	PUNJAB	NR
8	Ropar	ROPR	PSEB	Rupnager	PUNJAB	NR
9	Kota	KOTA	RSEB	Kota	RAJASTHAN	NR
10	Suratgarh	SRTG	RSEB	Suratgarh Tehsil	RAJASTHAN	NR
11	Barsingsar *(lignite: not in basis)*	BARS	-	-	RAJASTHAN	NR
12	Dadri	DADR	NTPC	New Delhi	U P	NR
13	Rihand Super	RIHN	NTPC	Renukoot	U P	NR
14	Singrauli Super	SING	NTPC	Singrauli	U P	NR
15	Tanda	TNDA	NTPC	Faizabad	U P	NR
16	Unchahar(FGU)	UNCH	NTPC	Raibareli	U P	NR
17	Anpara "A"	ANPA	UPSEB	Sonebhadra	U P	NR
18	Harduaganj 'A'	HRDG	UPSEB	Aligarh	U P	NR
19	Obra	OBRA	UPSEB	Sonebhadra	U P	NR
20	Panki	PNKI	UPSEB	Kanpur	U P	NR
21	Parichha	PARI	UPSEB	Jhansi	U P	NR
22	Bakreswar	BAKR	WBPDCL	Birbhum	W B	NR
23	Gandhinagar	GDHN	GEB	Gandhi Nagar	GUJARAT	WR
24	Sabarmati	SABR	AECO	Ahmedabad	GUJARAT	WR
25	Sikka	SIKK	GSEB	Jamnagar	GUJARAT	WR
26	Ukai	UKAI	GEB	Surat	GUJARAT	WR
27	Wanakbon Super	WNKB	GSEB	Sivalia	GUJARAT	WR
28	Amarkantak	AMKT	MPSEB	Shahdol	M P	WR
29	Korba East	KORE	MPSEB	Bilaspur	M P	WR
30	Korba West	KORW	MPSEB	Dhan	M P	WR
31	Sanjay Gandhi (Birsingpur)	BRSN	MPSEB	Shahdol	M P	WR
32	Satpura	SATP	MPSEB	Betul	M P	WR
33	Korba Super	KORS	NTPC	Korba	M P	WR
34	Vindhyachal Super	VNDH	NTPC	Singrauli	M P	WR
35	Bhusaval	BHUS	MSEB	Jalgaon	MAHARASHTRA	WR
36	Chandrapur	CHNR	MSEB	Beed	MAHARASHTRA	WR
37	Dahanu	DAHN	BSES	Bombay	MAHARASHTRA	WR
38	Khaperkheda	KPKH	MSEB	NAGPUR	MAHARASHTRA	WR
39	Koradi	KRDI	MSEB	Nagpur	MAHARASHTRA	WR
40	Nasik	NASK	MSEB	Nasik	MAHARASHTRA	WR
41	Paras	PARS	MSEB	Puras	MAHARASHTRA	WR
42	Parli	PARL	MSEB	Beed	MAHARASHTRA	WR
43	Trombay	TRMB	TEC	Bombay	MAHARASHTRA	WR

	Plant Name		Operator	Town	State	Region
44	Bhilai	BHIL				WR
45	Pench	PNCH				WR
46	Kothagudem	KOTH	APSEB	Khammam	A P	SR
47	Nellore	NELL	APSEB	Nellore	A P	SR
48	Ramagundam 'B'	RAMB	APSEB	Karimnagar	A P	SR
49	Rayalseema (Muddanur)	RAYL	APSEB		A P	SR
50	Vijaywada	VJWD	APSEB	Krishna	A P	SR
51	Ramagundam Super	RAMS	NTPC	Karimnagar	A P	SR
52	Raichur	RACH	KPCL	Raichur	KARNATAKA	SR
53	Ennore	ENNO	TNEB	Chennai	TN	SR
54	Mettur	METT	TNEB	Mettur	TN	SR
55	North Madras	NMAD	TNEB	Madras	TN	SR
56	Tuticorin	TUTI	TNEB	Tuticorin	TN	SR
57	Toranglu	TRGL				SR
58	Barauni	BRUN	BSEB	Begusarai	BIHAR	ER
59	Bokaro 'A'	BOKA	DVC	Dhanbad	BIHAR	ER
60	Bokaro 'B'	BOKB	DVC	Dhanbad	BIHAR	ER
61	Chandrapura	CHNA	DVC	Dhanbad	BIHAR	ER
62	Muzaffarpur	MUZF	BSEB	Muzaffarpur	BIHAR	ER
63	Patratu	PATR	BSEB	Hazaribagh	BIHAR	ER
64	Tenughat	TENU	TVNL	Hazaribagh	BIHAR	ER
65	Kahalgaon Super	KHLG	NTPC	Bhagalpur	BIHAR	ER
66	Talcher	TALC	NTPC	Angul	ORISSA	ER
67	Talcher Super (Kaniha)	TALS	NTPC	Angul	ORISSA	ER
68	IB	IBVL	OPGC	Sambalpur	ORISSA	ER
69	Farakka Super	FRKK	NTPC	Murshidabad	W B	ER
70	Bandel	BNDL	WBSEB	Hoogly	W B	ER
71	Budge Budge	BGBG	CESC	Calcutta	W B	ER
72	Durgapur DPL	DRGL	DPL	Durgapur	W B	ER
73	Durgapur DVC	DRGC	DVC	Durgapur	W B	ER
74	Kolaghat	KLGT	WBPDCL	Midnapore	W B	ER
75	Mejia	MEJI	DVC	Bankura	W B	ER
76	Mulajore	MLJR	CESC	Calcutta	W B	ER
77	New Cossipore	NCOS	CESC	Calcutta	W B	ER
78	Santaldih	SNTD	WBSEB	Purulia	W B	ER
79	Southern Gen	SGEN	CESC	Calcutta	W B	ER
80	Titagarh	TITG	CESC	Titagarh	W B	ER
81	Balagarh	BALA			W B	ER
82	IB-TPS 3&4	IBEX	OPGC	Sambalpur	ORISSA	ER
83	Maithon-R1	MAIT			BIHAR	ER
84	Tenughat-X	TNGX	TVNL	Hazaribagh	BIHAR	ER
85	Bongaigaon	BONG	ASEB	Bongaigaon	ASSAM	NE

Annexure 3.3 Capacity (MW) of power plants - 1998/99 to 2001/02

Plant Name	1998-99	1999-2000	2000-01	2001-02
Barauni	320	320	320	320
Bokaro 'A'	160	160	160	160
Bokaro 'B'	630	630	630	630
Chandrapura	780	780	780	780
Muzaffarpur	220	220	220	220
Patratu	770	770	770	770
Tenughat	420	420	420	420
Kahalgaon Super	840	840	840	840
Talcher	460	460	460	460
Talcher Super (Kaniha)	1000	1000	1000	1000
IB	420	420	420	420
Farakka Super	1600	1600	1600	1600
Bandel	530	530	530	530
Budge Budge	250	500	500	500
Durgapur DPL	390	390	390	390
Durgapur DVC	350	350	350	350
Kolaghat	1260	1260	1260	1260
Mejia	420	630	630	630
Mulajore	60	60	60	60
New Cossipore	130	130	130	130
Santaldih	480	480	480	480
Southern Gen	135	135	135	135
Titagarh	240	240	240	240
Balagarh	0	0	0	0
IB-TPS 3&4	0	0	0	0
Maithon-R1	0	0	0	0
Tenughat-X	0	0	0	0
Bongaigaon	240	240	240	240
Badarpur	705	705	705	705
Inderprastha	247.5	247.5	247.5	247.5
Rajghat	135	135	135	135
Faridabad	165	165	165	165
Panipat	650	650	650	650
Bhatinda	440	440	440	440
Lehra Mohabbat	420	420	420	420
Ropar	1260	1260	1260	1260
Kota	850	850	850	850
Suratgarh	250	250	500	500
Barsingsar-1	0	0	0	0
Dadri	840	840	840	840
Rihand Super	1000	1000	1000	1000
Singrauli Super	2000	2000	2000	2000

Plant Name	1998-99	1999-2000	2000-01	2001-02
Tanda	440	440	440	440
Unchahar	630	840	840	840
Anpara	1630	1630	1630	1630
Harduaganj	540	540	540	540
Obra	1482	1482	1482	1482
Panki	274	274	274	274
Parichha	220	220	220	220
Bakreswar	0	210	420	420
Kothagudem	1180	1180	1180	1180
Nellore	30	30	30	30
Ramagundam 'B'	62.5	62.5	62.5	62.5
Rayalseema (Muddanur)	420	420	420	420
Vijaywada	1260	1260	1260	1260
Ramagundam Super	2100	2100	2100	2100
Raichur	840	1260	1260	1260
Ennore	450	450	450	450
Mettur	840	840	840	840
North Madras	630	630	630	630
Tuticorin	1050	1050	1050	1050
Torangllu	0	0	0	0
Gandhinagar	870	870	870	870
Sabarmati	450	450	450	450
Sikka	240	240	240	240
Ukai	850	850	850	850
Wanakbori Super	1470	1470	1470	1470
Amarkantak	300	300	300	300
Korba East	400	400	400	400
Korba West	840	840	840	840
Sanjay Gandhi (Birsingpur)	420	630	840	840
Satpura (Sarni)	1142.5	1142.5	1142.5	1142.5
Korba Super	2100	2100	2100	2100
Vindhyachal Super	1260	1760	2260	2260
Bhusaval	478	478	478	478
Chandrapur	2340	2340	2340	2340
Dahanu	500	500	500	500
Khaperkheda	420	420	420	420
Koradi	1100	1100	1100	1100
Nasik	910	910	910	910
Paras	58	58	58	58
Parli	690	690	690	690
Trombay	1350	1350	1350	1350
Bhilai	0	0	0	0
Pench	0	0	0	0
TOTAL	53334.5	55344.5	56514.5	56514.5

Annexure 3.4 Plantwise PLFs (%) - 1998/99-2001/02

Plant Name	1998/99	1999/2000	2000/01	2001/02
Barauni	19.6	12.5	12.5	12.5
Bokaro 'A'	36.9	31.1	31.1	31.1
Bokaro 'B'	36.9	31.1	31.1	31.1
Chandrapura	29.3	25.9	25.9	25.9
Muzaffarpur	19.1	16.3	16.3	16.3
Patratu	24.7	23	23	23
Tenughat	40.1	33	33	33
Kahalgaon Super	54.2	55.9	55.9	55.9
Talcher	55.4	58.8	58.8	58.8
Talcher Super (Kaniha)	49.3	55.6	55.6	55.6
IB	76.2	84.1	84.1	84.1
Farakka Super	39	45.6	45.6	45.6
Bandel	38.3	47.8	47.8	47.8
Budge Budge				
Durgapur DPL	17.6	25.1	25.1	25.1
Durgapur DVC	49.5	48.3	48.3	48.3
Kolaghat	60.7	54.7	54.7	54.7
Mejia	54.4	39.8	39.8	39.8
Mulajore	60.9			
New Cossipore	65.1	45.8	45.8	45.8
Santaldih	35.1	31.6	31.6	31.6
Southern Gen	66.2	65.6	65.6	65.6
Titagarh	85.8	76.8	76.8	76.8
Balagarh	64	64	64	64
IB-TPS 3&4	76.2	84.1	84.1	84.1
Maithon-R1	64	64	64	64
Tenughat-X	64	64	64	64
Bongaigaon	3.6	4.9	4.9	4.9
Badarpur	78.8	78.7	78.7	78.7
Inderprastha	31.4	34.5	34.5	34.5
Rajghat	52.3	77.5	77.5	77.5
Faridabad	59.4	64.3	64.3	64.3
Panipat	46.2	49.7	49.7	49.7
Bhatinda	68.3	67.7	67.7	67.7
Lehra Mohabbat	60	87.3	87.3	87.3
Ropar	69.9	75.7	75.7	75.7
Kota	78.8	81.9	81.9	81.9
Suratgarh	70.4	74.3	74.3	74.3
Barsingsar-1	64	64	64	64
Dadri	91.4	96.1	96.1	96.1
Rihand Super	77.8	84.2	84.2	84.2
Singrauli Super	90.3	93.1	93.1	93.1
Tanda	30.6	20.3	20.3	20.3

Plant Name	1998/99	1999/2000	2000/01	2001/02
Unchahar	82.2	83.2	83.2	83.2
Anpara	76.8	78.3	78.3	78.3
Harduaganj	21.7	16.1	16.1	16.1
Obra	33.3	36	36	36
Panki	32.4	38.5	38.5	38.5
Panchha	43.5	30.4	30.4	30.4
Bakreswar	60	60	60	60
Kothagudem	60.3	73.7	73.7	73.7
Nellore	36.5	56.7	56.7	56.7
Ramagundam 'B'	72.9	75.8	75.8	75.8
Rayalseema (Muddanur)	91.5	94.5	94.5	94.5
Vijaywada	88.2	85.8	85.8	85.8
Ramagundam Super	86.2	89.7	89.7	89.7
Raichur	81.6	81	81	81
Ennore	45.6	35.8	35.8	35.8
Mettur	68.8	75.1	75.1	75.1
North Madras	66.6	74.8	74.8	74.8
Tuticorin	71.7	77.8	77.8	77.8
Torangllu	64	64	64	64
Gandhinagar	69.6	55	55	55
Sabarmati	75	83.3	83.3	83.3
Sikka	42.1	45.8	45.8	45.8
Ukai	58.6	60.3	60.3	60.3
Wanakbori Super	76.3	82.7	82.7	82.7
Amarkantak	47.3	73.4	73.4	73.4
Korba East	50.5	64.5	64.5	64.5
Korba West	69.1	67.2	67.2	67.2
Sanjay Gandhi (Birsingpur)	68.4	64	64	64
Satpura (Sami)	76.3	83	83	83
Korba Super	86.4	83.8	83.8	83.8
Vindhyachal Super	88.9	86.6	86.6	86.6
Bhusaval	68.5	79.3	79.3	79.3
Chandrapur	65.8	74.7	74.7	74.7
Dahanu	74.8	85.9	85.9	85.9
Khaperkheda	80.2	64	64	64
Koradi	62	58.2	58.2	58.2
Nasik	67.9	72.4	72.4	72.4
Paras	59.2	76.5	76.5	76.5
Parli	73.9	70.3	70.3	70.3
Trombay	61.2	62.1	62.1	62.1
Bhilai	64	64	64	64
Pench	64	64	64	64

Annexure 3.5 Plantwise generation (Gwh) - 1998/99-2001/02

Plant Name	1998/99	1999/2000	2000/01	2001/02
Barauni	549	350	350	350
Bokaro 'A'	517	436	436	436
Bokaro 'B'	2036	1716	1716	1716
Chandrapura	2002	1770	1770	1770
Muzaffarpur	368	314	314	314
Patratu	1666	1551	1551	1551
Tenughat	1475	1214	1214	1214
Kahalgaon Super	3988	4113	4113	4113
Talcher	2232	2369	2369	2369
Talcher Super (Kaniha)	4319	4871	4871	4871
IB	2804	3094	3094	3094
Farakka Super	5466	6391	6391	6391
Bandel	1778	2219	2219	2219
Budge Budge	767	1533	1533	1533
Durgapur DPL	601	858	858	858
Durgapur DVC	1518	1481	1481	1481
Kolaghat	6700	6038	6038	6038
Mejia	2001	2196	2196	2196
Mulajore	320	320	320	320
New Cossipore	741	522	522	522
Santaldih	1476	1329	1329	1329
Southern Gen	783	776	776	776
Titagarh	1804	1615	1615	1615
Balagarh	0	0	0	0
IB-TPS 3&4	0	0	0	0
Maithon-R1	0	0	0	0
Tenughat-X	0	0	0	0
Bongaigaon	76	103	103	103
Badarpur	4867	4860	4860	4860
Inderprastha	681	748	748	748
Rajghat	618	917	917	917
Faridabad	859	929	929	929
Panipat	2631	2830	2830	2830
Bhatinda	2633	2609	2609	2609
Lehra Mohabbat	2208	3212	3212	3212
Ropar	7715	8355	8355	8355
Kota	5867	6098	6098	6098
Suratgarh	1542	1627	3254	3254
Barsingsar-1	0	0	0	0
Dadri	6726	7071	7071	7071
Rihand Super	6815	7376	7376	7376
Singrauli Super	15821	16311	16311	16311
Tanda	1179	782	782	782

Plant Name	1998/99	1999/2000	2000/01	2001/02
Unchahar	4536	6122	6122	6122
Anpara	10966	11180	11180	11180
Harduaganj	1026	762	762	762
Obra	4323	4674	4674	4674
Panki	778	924	924	924
Panchha	838	586	586	586
Bakreswar	0	1104	2208	2208
Kothagudem	6233	7618	7618	7618
Nellore	96	149	149	149
Ramagundam 'B'	399	415	415	415
Rayalseema (Muddanur)	3366	3477	3477	3477
Vijaywada	9735	9470	9470	9470
Ramagundam Super	15857	16501	16501	16501
Raichur	6004	8940	8940	8940
Ennore	1798	1411	1411	1411
Mettur	5063	5526	5526	5526
North Madras	3676	4128	4128	4128
Tuticorin	6595	7156	7156	7156
Toranglllu	0	0	0	0
Gandhinagar	5304	4192	4192	4192
Sabarmati	2957	3284	3284	3284
Sikka	885	963	963	963
Ukai	4363	4490	4490	4490
Wanakbori Super	9825	10649	10649	10649
Amarkantak	1243	1929	1929	1929
Korba East	1770	2260	2260	2260
Korba West	5085	4945	4945	4945
Sanjay Gandhi (Birsingpur)	2517	3532	4709	4709
Satpura (Sami)	7636	8307	8307	8307
Korba Super	15894	15416	15416	15416
Vindhyachal Super	9812	13352	17145	17145
Bhusaval	2868	3321	3321	3321
Chandrapur	13488	15312	15312	15312
Dahanu	3276	3762	3762	3762
Khaperkheda	2951	2355	2355	2355
Koradi	5974	5608	5608	5608
Nasik	5413	5771	5771	5771
Paras	301	389	389	389
Parli	4467	4249	4249	4249
Trombay	7238	7344	7344	7344
Bhilai	0	0	0	0
Pench	0	0	0	0

Annexure 3.6 Plantwise heat rates (kcal/Kwh)

Plant Name	1998/99
Barauni	3512
Bokaro 'A'	3778
Bokaro 'B'	3500
Chandrapura	4031
Muzaffarpur	3264
Patratu	3054
Tenughat	2721
Kahalgaon Super	3208
Talcher	3459
Talcher Super (Kaniha)	3171
IB	5397
Farakka Super	3941
Bandel	3816
Budge Budge	4242
Durgapur DPL	3395
Durgapur DVC	2525
Kolaghat	2624
Mejia	3500
Mulajore	3500
New Cossipore	3500
Santaldih	2570
Southern Gen	2548
Titagarh	2556
Balagarh	3500
IB-TPS 3&4	3500
Malthon-R1	3500
Tenughat-X	3500
Bongaigaon	2755
Badarpur	3355
Inderprastha	3230
Rajghat	2546
Faridabad	2853
Panipat	3352
Bhatinda	2985
Lehra Mohabbat	3936
Ropar	2755
Kota	3286
Suratgarh	3373
Barsingsar-1	3502
Dadri	4071
Rihand Super	2779
Singrauli Super	3500
Tanda	2876

Plant Name	1998/99
Unchahar	3500
Anpara	3500
Harduaganj	2253
Obra	3327
Panki	3465
Parichha	2134
Bakreswar	3500
Kothagudem	2775
Nellore	2506
Ramagundam 'B'	1915
Rayalseema (Muddanur)	3042
Vijaywada	2395
Ramagundam Super	2915
Raichur	3500
Ennore	3500
Mettur	5102
North Madras	3903
Tuticorin	3570
Torangllu	3500
Gandhinagar	3889
Sabarmati	3381
Sikka	3350
Ukai	3503
Wanakbori Super	3051
Amarkantak	2970
Korba East	3690
Korba West	3846
Sanjay Gandhi (Birsingpur)	2941
Satpura (Sami)	2773
Korba Super	3500
Vindhyachal Super	3500
Bhusaval	3500
Chandrapur	3500
Dahanu	3500
Khaperkheda	3500
Koradi	3500
Nasik	3500
Paras	3500
Parli	3500
Trombay	3500
Bhilai	3500
Pench	3500

Annexure 3.7 List of supply points (coalfields & ports)

Coalfields

1.	RNJ	Raniganj
2.	JHA	Jharia
3.	EBK	East Bokaro
4.	WBK	West Bokaro
5.	SNG	Singrauli
6.	PEN	Pench-Kanhan (Patherkheda)
7.	WRD	Wardha Valley
8.	NAG	Nagpur (Kamptee-Umrer)
9.	NKN	North Karanpura
10.	SKN	South Karanpura
11.	RMG	Ramgarh
12.	GDH	Giridih
13.	RAJ	Rajmahal
14.	TLC	Talcher
15.	IBV	Ib Valley
16.	KRB	Korba
17.	SHG	Sohagpur
18.	GDV	Godavari
19.	NEC	North Eastern
20.	KRW	Korea Rewa
21.	MRG	Mand Raigarh
22.	TLP	Talcher Paradip
23.	JHH	Jharia Haldia
24.	RNH	Raniganj Haldia
25.	IBP	Ib Paradip
26.	IBZ	Ib Vizag
27.	KRP	Korba Paradip
28.	KRV	Korba Vizag
29.	MRP	Raigarh Paradip
30.	MRV	Raigarh Vizag
31.	KWP	KoreaRewa Paradip
32.	KWV	KoreaRewa Vizag

Ports

1.	BOMB	Bombay
2.	COCH	Cochin
3.	JNPT	J N Port
4.	KNDL	Kandla
5.	VADI	Vadinar
6.	MANG	Mangalore
7.	MORM	Mormugao
8.	PIPV	Pipavav
9.	CALC	Calcutta
10.	CHEN	Chennai
11.	PARA	Paradip
12.	TUTN	Tuticorin
13.	VSKN	Visakhapatnam
14.	HALD	Haldia

Note: Coalfield nodes 22-32 are incorporated to reflect coal movement by rail cum sea route

Annexure 3.8 Grade-wise production by coalfield (Mt) - 1998/99

dummy	AG	BG	DG	EG	FG	GG	LG	IG	TOTAL
RNJ	7.6	7.6	0	0	0	0	0	0	15.3
JHA	0.8	3.5	3.5	1.7	0	0	12.1	0	21.6
EBK	0	0	0	1.4	1.4	0	1.0	0	3.8
WBK	0	0.1	0	0	0	0	0.9	0	1.0
SNG	0	10.4	10.4	7.8	7.8	0	0	0	36.5
PEN	0	2.7	1.2	1.2	0.7	0	0	0	5.8
WRD	0	4.5	4.5	10.1	0	0	0	0	19.2
NAG	0	2.7	2.7	0.6	0	0	0	0	6.1
NKN	0.2	0.2	5.0	7.3	7.3	0	0	0	15.1
SKN	0.9	0.9	0.9	0.6	0.6	0	0	0	3.9
RMG	0	0	0	0	0	0	1.1	0	1.1
GDH	0	0	0	0.1	0.1	0	0	0	0.2
RAJ	0	0	0	0	4.2	4.2	0	0	8.4
TLC	0.5	0.5	0.5	13.7	13.7	0	0	0	29.0
IBV	0	0.6	0.6	6.6	6.6	0	0	0	14.5
KRB	0	1.9	11.3	11.3	11.3	0	0	0	35.9
SHG	3.5	3.5	3.5	0.2	0	0	0.1	0	10.7
GDV	0	6.6	6.7	8.8	5.2	0	0	0	27.3
NEC	0.6	0.1	0	0	0	0	0	0	0.6
KRW	3.5	3.5	3.5	0.2	0	0	0.1	0	10.7
MRG	0	0	0.3	0	0	0	0	0	0.3
BOMB	0	0	0	0	0	0	0	5.0	5.0
COCH	0	0	0	0	0	0	0	0	0
JNPT	0	0	0	0	0	0	0	0	0
KNDL	0	0	0	0	0	0	0	5.0	5.0
VADI	0	0	0	0	0	0	0	0	0
MANG	0	0	0	0	0	0	0	0	0
MORM	0	0	0	0	0	0	0	5.0	5.0
PIPV	0	0	0	0	0	0	0	5.0	5.0
CALC	0	0	0	0	0	0	0	0	0
CHEN	0	0	0	0	0	0	0	0	0
PARA	0	0	0	0	0	0	0	0	0
TUTN	0	0	0	0	0	0	0	0	0
VSKN	0	0	0	0	0	0	0	0	0
HALD	0	0	0	0	0	0	0	0	0
TOTAL	17.7	49.3	49.8	71.6	59.1	4.2	15.4	20	287.1

Note:

- Production at Godavari is kept constant at 99/00 level for 2000/01 & 2001/02.
- The maximum import is also kept constant at a total of 20 mt at the ports on the Western coast.
- Additional supply nodes have been incorporated to account for coal movement by the rail cum sea routes

Annexure 3.9 Grade-wise production by coalfield (Mt) - 1999/00

Dummy	AG	BG	DG	EG	FG	GG	LG	IG	TOTAL
RNJ	7.6	7.6	0.1	0	0	0	0	0	15.2
JHA	0.9	3.7	3.7	2.1	0	0	13.2	0	23.7
EBK	0	0	0	1.2	1.2	0	3.0	0	5.5
WBK	0	0.1	0	0	0	0	1.5	0	1 6
SNG	0	10.8	10.8	8.0	8.0	0	0	0	37.5
PEN	0	2.3	1.1	1.1	0.7	0	0	0	5.2
WRD	0	4.8	4.8	10.2	0	0	0	0	19.7
NAG	0	2.8	2.8	0.8	0	0	0	0	6.3
NKN	0.2	0.2	6.0	6.8	6.8	0	0	0	20.1
SKN	0.8	0.8	0.8	0.7	0.7	0	0	0	3.8
RMG	0	0	0	0	0	0	1.0	0	1.0
GDH	0	0	0	0.1	0.1	0	0	0	0.2
RAJ	0	0	0	0	4 5	4.5	0	0	9.0
TLC	0.5	0.5	0.5	13.3	13.3	0	0	0	28.0
IBV	0	0.6	0.6	6.4	6.4	0	0	0	14.0
KRB	0	1.9	11.3	11.3	11.3	0	0	0	35.8
SHG	3.5	3.5	3.5	0.2	0	0	0.2	0	10.9
GDV	0	7.1	7.3	9.5	5.6	0	0	0	29.6
NEC	0.5	0	0	0	0	0	0	0	0.5
KRW	3.5	3.5	3.5	0.2	0	0	0.2	0	10 9
MRG	0	0	0.4	0	0	0	0	0	0 4
BOMB	0	0	0	0	0	0	0	5.0	5.0
COCH	0	0	0	0	0	0	0	0	0
JNPT	0	0	0	0	0	0	0	0	0
KNDL	0	0	0	0	0	0	0	5.0	5.0
VADI	0	0	0	0	0	0	0	0	0
MANG	0	0	0	0	0	0	0	0	0
MORM	0	0	0	0	0	0	0	5 0	5 0
PIPV	0	0	0	0	0	0	0	5.0	5.0
CALC	0	0	0	0	0	0	0	0	0
CHEN	0	0	0	0	0	0	0	0	0
PARA	0	0	0	0	0	0	0	0	0
TUTN	0	0	0	0	0	0	0	0	0
VSKN	0	0	0	0	0	0	0	0	0
HALD	0	0	0	0	0	0	0	0	0
TOTAL	17.5	49 7	50.5	71 1	58.3	4.5	19.0	20	290.6

Note: Additional supply nodes have been incorporated to account for coal movement by the rail cum sea routes

Annexure 3.10 Grade-wise production by coalfield (Mt) - 2000/01

dummy	AG	BG	DG	EG	FG	GG	LG	IG	TOTAL
RNJ	7.8	7.8	0	0	0	0	0	0	15.7
JHA	0.8	3.6	3.6	1.7	0	0	13.9	0	23.6
EBK	0	0	0	1.2	1.2	0	3.5	0	5.9
WBK	0	0.2	0	0	0	0	1.8	0	1.9
SNG	0	13.3	13.3	6.3	6.3	0	0	0	39.0
PEN	0	2.3	1.1	1.1	0.7	0	0	0	5.2
WRD	0	5.2	5.2	10.1	0	0	0	0	20.6
NAG	0	2.8	2.8	0.8	0	0	0	0	6.4
NKN	0.3	0.3	6.0	7.2	7.2	0	0	0	21.0
SKN	0.9	0.9	0.9	0.7	0.7	0	0	0	4.0
RMG	0	0	0	0	0	0	1.1	0	1.1
GDH	0	0	0	0.1	0.1	0	0	0	0.2
RAJ	0	0	0	0	4.5	4.5	0	0	9.0
TLC	0.5	0.5	0.5	13.7	13.7	0	0	0	28.9
IBV	0	0.6	0.6	6.5	6.5	0	0	0	14.1
KRB	0	1.9	11.8	11.8	11.8	0	0	0	37.2
SHG	3.6	3.6	3.6	0.2	0	0	0.2	0	11.2
GDV	0	7.1	7.3	9.5	5.6	0	0	0	29.6
NEC	0.5	0	0	0	0	0	0	0	0.5
KRW	3.6	3.6	3.6	0.2	0	0	0.2	0	11.2
MRG	0	0	0.4	0	0	0	0	0	0.4
BOMB	0	0	0	0	0	0	0	5.0	5.0
COCH	0	0	0	0	0	0	0	0	0
JNPT	0	0	0	0	0	0	0	0	0
KNDL	0	0	0	0	0	0	0	5.0	5.0
VADI	0	0	0	0	0	0	0	0	0
MANG	0	0	0	0	0	0	0	0	0
MORM	0	0	0	0	0	0	0	5.0	5.0
PIPV	0	0	0	0	0	0	0	5.0	5.0
CALC	0	0	0	0	0	0	0	0	0
CHEN	0	0	0	0	0	0	0	0	0
PARA	0	0	0	0	0	0	0	0	0
TUTN	0	0	0	0	0	0	0	0	0
VSKN	0	0	0	0	0	0	0	0	0
HALD	0	0	0	0	0	0	0	0	0
TOTAL	17.9	53.2	54.1	70.3	57.9	4.5	20.6	20	298.5

Note: Additional supply nodes have been incorporated to account for coal movement by the rail cum sea routes

Annexure 3.11 Grade-wise production by coalfield (Mt) - 2001/02

Dummy	AG	BG	DG	EG	FG	GG	LG	IG	TOTAL
RNJ	8.6	8.6	0	0	0	0	0	0	17.1
JHA	0.7	3.5	3.5	1.5	0	0	14.3	0	23.5
EBK	0	0	0	1.3	1.3	0	4.0	0	6.7
WBK	0	0.4	0	0	0	0	2.2	0	2.6
SNG	0	14.5	14.5	6.3	6.3	0	0	0	41.5
PEN	0	2.4	1.1	1.0	0.7	0	0	0	5.2
WRD	0	5.4	5.4	10.2	0	0	0	0	21.0
NAG	0	3.0	3.0	1.0	0	0	0	0	7.0
NKN	0.3	0.3	6.0	7.5	7.5	0	0	0	21.6
SKN	0.9	0.9	0.9	0.7	0.7	0	0	0	4.0
RMG	0	0	0	0	0	0	1.1	0	1.1
GDH	0	0	0	0.1	0.1	0	0	0	0.2
RAJ	0	0	0	0	4.8	4.8	0	0	9.5
TLC	0.5	0.5	0.5	14.9	14.9	0	0	0	31.3
IBV	0	0.6	0.6	7.5	7.5	0	0	0	16.2
KRB	0	2.1	12.7	12.7	12.7	0	0	0	40.3
SHG	4.1	4.1	4.1	0.2	0	0	0.2	0	12.6
GDV	0	7.1	7.3	9.5	5.6	0	0	0	29.6
NEC	0.5	0	0	0	0	0	0	0	0.5
KRW	4.1	4.1	4.1	0.2	0	0	0.2	0	12.6
MRG	0	0	0.4	0	0	0	0	0	0.4
BOMB	0	0	0	0	0	0	0	5.0	5.0
COCH	0	0	0	0	0	0	0	0	0
JNPT	0	0	0	0	0	0	0	0	0
KNDL	0	0	0	0	0	0	0	5.0	5.0
VADI	0	0	0	0	0	0	0	0	0
MANG	0	0	0	0	0	0	0	0	0
MORM	0	0	0	0	0	0	0	5.0	5.0
PIPV	0	0	0	0	0	0	0	5.0	5.0
CALC	0	0	0	0	0	0	0	0	0
CHEN	0	0	0	0	0	0	0	0	0
PARA	0	0	0	0	0	0	0	0	0
TUTN	0	0	0	0	0	0	0	0	0
VSKN	0	0	0	0	0	0	0	0	0
HALD	0	0	0	0	0	0	0	0	0
TOTAL	19.6	56.8	57.6	73.9	61.7	4.8	22.0	20	316.2

Note: Additional supply nodes have been incorporated to account for coal movement by the rail cum sea routes

Annexure 3.12 Grade-wise calorific value (UHV) of coal by coalfield used in the model (kcal/kg)

Dummy	AG	BG	DG	EG	FG	GG	LG	IG
RNJ	6200	5270	4570	3780	999	999	999	999
JHA	6200	5270	4570	3780	2880	999	3780	999
EBK	999	999	999	3780	2880	999	3780	999
WBK	999	5270	999	999	999	999	3780	999
SNG	999	5270	4570	3780	2880	999	999	999
PEN	999	5270	4570	3780	2880	999	999	999
WRD	999	5270	4570	3780	999	999	999	999
NAG	999	5270	4570	3780	999	999	999	999
NKN	6200	5270	4570	3780	2880	999	999	999
SKN	6200	5270	4570	3780	2880	999	999	999
RMG	999	999	999	999	999	999	3780	999
GDH	999	999	999	3780	2880	999	999	999
RAJ	999	999	4570	3780	2880	1850	999	999
TLC	6200	5270	4570	3780	2880	999	999	999
IBV	999	5270	4570	3780	2880	999	999	999
KRB	999	5270	4570	3780	2880	999	999	999
SHG	6200	5270	4570	3780	999	999	3780	999
GDV	999	5270	4570	3780	2880	1850	999	999
NEC	6200	5270	999	999	2880	999	999	999
KRW	6200	5270	4570	3780	999	999	3780	999
MRG	999	999	4570	3780	2880	999	999	999
BOMB	999	999	999	999	999	999	999	6250
COCH	999	999	999	999	999	999	999	6250
JNPT	999	999	999	999	999	999	999	6250
KNDL	999	999	999	999	999	999	999	6250
VADI	999	999	999	999	999	999	999	6250
MANG	999	999	999	999	999	999	999	6250
MORM	999	999	999	999	999	999	999	6250
PIPV	999	999	999	999	999	999	999	6250
CALC	999	999	999	999	999	999	999	6250
CHEN	999	999	999	999	999	999	999	6250
PARA	999	999	999	999	999	999	999	6250
TUTN	999	999	999	999	999	999	999	6250
VSKN	999	999	999	999	999	999	999	6250
HALD	999	999	999	999	999	999	999	6250

Note: Additional supply nodes have been incorporated to account for coal movement by the rail cum sea routes

The figure 999 reflects the non-availability of that particular grade at the coalfield

Annexure 3.13 Coal prices by coalfield - 1998/99 (Rs/ton)

dummy	AG	BG	DG	EG	FG	GG	LG	IG
RNJ	1418	1181	866	570	461	338	570	9999
JHA	1034	898	642	530	422	323	530	9999
EBK	1108	916	642	530	422	323	530	9999
WBK	1108	916	642	530	422	323	530	9999
SNG	959	879	642	530	422	323	530	9999
PEN	1138	1028	881	749	620	486	749	9999
WRD	1138	1028	881	749	620	486	749	9999
NAG	1138	1028	881	749	620	486	749	9999
NKN	1108	916	798	530	422	323	530	9999
SKN	1108	916	642	530	422	323	530	9999
RMG	1108	916	642	530	422	323	530	9999
GDH	1108	916	642	530	422	323	530	9999
RAJ	9999	9999	679	635	570	472	635	9999
TLC	1026	848	621	513	408	313	513	9999
IBV	1026	848	621	513	408	313	513	9999
KRB	1108	916	642	530	422	323	530	9999
SHG	1108	916	642	530	422	323	530	9999
GDV	9999	1071	898	721	601	453	9999	9999
NEC	1126	915	687	566	452	347	566	9999
KRW	1108	916	642	530	422	323	530	9999
MRG	1108	916	642	530	422	323	530	9999
BOMB	9999	9999	9999	9999	9999	9999	9999	1540
COCH	9999	9999	9999	9999	9999	9999	9999	1540
JNPT	9999	9999	9999	9999	9999	9999	9999	1540
KNDL	9999	9999	9999	9999	9999	9999	9999	1540
VADI	9999	9999	9999	9999	9999	9999	9999	1540
MANG	9999	9999	9999	9999	9999	9999	9999	1540
MORM	9999	9999	9999	9999	9999	9999	9999	1540
PIPV	9999	9999	9999	9999	9999	9999	9999	1540
CALC	9999	9999	9999	9999	9999	9999	9999	1540
CHEN	9999	9999	9999	9999	9999	9999	9999	1540
PARA	9999	9999	9999	9999	9999	9999	9999	1540
TUTN	9999	9999	9999	9999	9999	9999	9999	1540
VSKN	9999	9999	9999	9999	9999	9999	9999	1540
HALD	9999	9999	9999	9999	9999	9999	9999	1540
TLP	1026	848	621	513	408	313	513	9999
JHH	1034	898	642	530	422	323	530	9999
RNH	1418	1181	866	570	461	338	570	9999
IBP	1026	848	621	513	408	313	513	9999
IBZ	1026	848	621	513	408	313	513	9999
KRP	1108	916	642	530	422	323	530	9999
KRV	1108	916	642	530	422	323	530	9999
MRP	1108	916	642	530	422	323	530	9999
MRV	1108	916	642	530	422	323	530	9999
KWP	1108	916	642	530	422	323	530	9999
KWV	1108	916	642	530	422	323	530	9999

Note:

1. The figure 9999 in any cell represents that the particular entry is not relevant for calculations
2. Price of imported coal : Rs1064/ton @ 28$/ton & Rs 38/$
3. Prices for E,F & G grades of coal in Raniganj are assumed to be equivalent to prices of CCL for the same grades for 1998/99 due to unavailability of prices for these grades in the price list

Annexure 3.14 Coal prices by coalfield - 1999/00 (Rs/ton)

Dummy	AG	BG	DG	EG	FG	GG	LG	IG
RNJ	1337	1165	856	608	491	360	608	9999
JHA	1155	955	681	560	446	341	560	9999
EBK	1108	916	681	560	446	341	560	9999
WBK	1108	916	681	560	446	341	560	9999
SNG	1108	916	681	560	446	341	560	9999
PEN	1177	1063	928	789	653	511	789	9999
WRD	1177	1063	928	789	653	511	789	9999
NAG	1177	1063	928	789	653	511	789	9999
NKN	1108	916	837	560	446	341	560	9999
SKN	1108	916	681	560	446	341	560	9999
RMG	1108	916	681	560	446	341	560	9999
GDH	1108	916	681	560	446	341	560	9999
RAJ	9999	9999	906	719	605	500	719	9999
TLC	1069	883	658	542	431	329	542	9999
IBV	1069	883	658	542	431	329	542	9999
KRB	1108	916	681	560	446	341	560	9999
SHG	1108	916	681	560	446	341	560	9999
GDV	9999	1106	927	741	618	465	741	9999
NEC	1147	935	708	587	473	368	587	9999
KRW	1108	916	681	560	446	341	560	9999
MRG	1108	916	681	560	446	341	560	9999
BOMB	9999	9999	9999	9999	9999	9999	9999	1530
COCH	9999	9999	9999	9999	9999	9999	9999	1530
JNPT	9999	9999	9999	9999	9999	9999	9999	1530
KNDL	9999	9999	9999	9999	9999	9999	9999	1530
VADI	9999	9999	9999	9999	9999	9999	9999	1530
MANG	9999	9999	9999	9999	9999	9999	9999	1530
MORM	9999	9999	9999	9999	9999	9999	9999	1530
PIPV	9999	9999	9999	9999	9999	9999	9999	1530
CALC	9999	9999	9999	9999	9999	9999	9999	1530
CHEN	9999	9999	9999	9999	9999	9999	9999	1530
PARA	9999	9999	9999	9999	9999	9999	9999	1530
TUTN	9999	9999	9999	9999	9999	9999	9999	1530
VSKN	9999	9999	9999	9999	9999	9999	9999	1530
HALD	9999	9999	9999	9999	9999	9999	9999	1530
TLP	1069	883	658	542	431	329	542	9999
JHH	1155	955	681	560	446	341	560	9999
RNH	1337	1165	856	608	491	360	608	9999
IBP	1069	883	658	542	431	329	542	9999
IBZ	1069	883	658	542	431	329	542	9999
KRP	1108	916	681	560	446	341	560	9999
KRV	1108	916	681	560	446	341	560	9999
MRP	1108	916	681	560	446	341	560	9999
MRV	1108	916	681	560	446	341	560	9999
KWP	1108	916	681	560	446	341	560	9999
KWV	1108	916	681	560	446	341	560	9999

Note:

1. The figure 9999 in any cell represents that the particular entry is not relevant for calculations
2. Price of imported coal : Rs1200/ton @ 30$/ton & Rs 40/$

Annexure 3.15 Coal prices by coalfield - 2000/01 (Rs/ton)

dummy	AG	BG	DG	EG	FG	GG	LG	IG
RNJ	1428	1244	914	648	522	382	648	9999
JHA	1251	1034	737	592	471	358	592	9999
EBK	1155	955	710	583	464	354	583	9999
WBK	1155	955	710	583	464	354	583	9999
SNG	1164	963	716	588	467	356	588	9999
PEN	1177	1063	928	789	653	511	789	9999
WRD	1177	1063	928	789	653	511	789	9999
NAG	1177	1063	928	789	653	511	789	9999
NKN	1155	955	866	583	464	354	583	9999
SKN	1155	955	710	583	464	354	583	9999
RMG	1155	955	710	583	464	354	583	9999
GDH	1155	955	710	583	464	354	583	9999
RAJ	9999	9999	963	762	641	529	9,999	9999
TLC	1069	883	658	542	431	329	542	9999
IBV	1069	883	658	542	431	329	542	9999
KRB	1108	916	681	560	446	341	560	9999
SHG	1108	916	681	560	446	341	560	9999
GDV	9999	1106	927	741	618	465	9,999	9999
NEC	1126	915	687	566	452	347	566	9999
KRW	1108	916	681	560	446	341	560	9999
MRG	1108	916	681	560	446	341	560	9999
BOMB	9999	9999	9999	9999	9999	9999	9999	1810
COCH	9999	9999	9999	9999	9999	9999	9999	1810
JNPT	9999	9999	9999	9999	9999	9999	9999	1810
KNDL	9999	9999	9999	9999	9999	9999	9999	1810
VADI	9999	9999	9999	9999	9999	9999	9999	1810
MANG	9999	9999	9999	9999	9999	9999	9999	1810
MORM	9999	9999	9999	9999	9999	9999	9999	1810
PIPV	9999	9999	9999	9999	9999	9999	9999	1810
CALC	9999	9999	9999	9999	9999	9999	9999	1810
CHEN	9999	9999	9999	9999	9999	9999	9999	1810
PARA	9999	9999	9999	9999	9999	9999	9999	1810
TUTN	9999	9999	9999	9999	9999	9999	9999	1810
VSKN	9999	9999	9999	9999	9999	9999	9999	1810
HALD	9999	9999	9999	9999	9999	9999	9999	1810
TLP	1069	883	658	542	431	329	542	9999
JHH	1251	1034	737	592	471	358	592	9999
RNH	1428	1244	914	648	522	382	648	9999
IBP	1069	883	658	542	431	329	542	9999
IBZ	1069	883	658	542	431	329	542	9999
KRP	1108	916	681	560	446	341	560	9999
KRV	1108	916	681	560	446	341	560	9999
MRP	1108	916	681	560	446	341	560	9999
MRV	1108	916	681	560	446	341	560	9999
KWP	1108	916	681	560	446	341	560	9999
KWV	1108	916	681	560	446	341	560	9999

Note:

1. The figure 9999 in any cell represents that the particular entry is not relevant for calculations
2. Price of imported coal . Rs1462/ton @ 34$/ton & Rs 43/$

Annexure 3.16 Coal prices by coalfield - 2001/02 (Rs/ton)

dummy	AG	BG	DG	EG	FG	GG	LG	IG
RNJ	1569	1365	1002	711	572	417	711	9999
JHA	1359	1123	801	731	510	386	731	9999
EBK	1309	1081	804	658	525	382	658	9999
WBK	1309	1081	804	658	525	382	658	9999
SNG	1280	1057	788	645	513	388	645	9999
PEN	1223	1104	966	834	690	539	834	9999
WRD	1223	1104	966	834	690	539	834	9999
NAG	1223	1104	966	834	690	539	834	9999
NKN	1309	1081	960	658	525	371	658	9999
SKN	1309	1081	804	658	525	371	658	9999
RMG	1309	1081	804	658	525	371	658	9999
GDH	1309	1081	804	658	525	371	658	9999
RAJ	9999	9999	1049	828	697	575	828	9999
TLC	1113	920	686	560	441	336	560	9999
IBV	1113	920	686	560	441	336	560	9999
KRB	1136	970	721	614	488	371	614	9999
SHG	1136	970	721	614	488	371	614	9999
GDV	9999	1071	898	721	601	453	9999	9999
NEC	1203	915	687	566	452	347	566	9999
KRW	1136	970	721	614	488	371	614	9999
MRG	1136	970	721	614	488	371	614	9999
BOMB	9999	9999	9999	9999	9999	9999	9999	2423
COCH	9999	9999	9999	9999	9999	9999	9999	2423
JNPT	9999	9999	9999	9999	9999	9999	9999	2423
KNDL	9999	9999	9999	9999	9999	9999	9999	2423
VADI	9999	9999	9999	9999	9999	9999	9999	2423
MANG	9999	9999	9999	9999	9999	9999	9999	2423
MORM	9999	9999	9999	9999	9999	9999	9999	2423
PIPV	9999	9999	9999	9999	9999	9999	9999	2423
CALC	9999	9999	9999	9999	9999	9999	9999	2423
CHEN	9999	9999	9999	9999	9999	9999	9999	2423
PARA	9999	9999	9999	9999	9999	9999	9999	2423
TUTN	9999	9999	9999	9999	9999	9999	9999	2423
VSKN	9999	9999	9999	9999	9999	9999	9999	2423
HALD	9999	9999	9999	9999	9999	9999	9999	2423
TLP	1113	920	686	560	441	336	560	9999
JHH	1359	1123	801	731	510	386	731	9999
RNH	1569	1365	1002	711	572	417	711	9999
IBP	1113	920	686	560	441	336	560	9999
IBZ	1113	920	686	560	441	336	560	9999
KRP	1136	970	721	614	488	371	614	9999
KRV	1136	970	721	614	488	371	614	9999
MRP	1136	970	721	614	488	371	614	9999
MRV	1136	970	721	614	488	371	614	9999
KWP	1136	970	721	614	488	371	614	9999
KWV	1136	970	721	614	488	371	614	9999

Note:

1. The figure 9999 in any cell represents that the particular entry is not relevant for calculations
2. Price of imported coal : Rs1748/ton @ 38$/ton & Rs 46/$

Annexure 3.17 Linkage matrix between demand-supply nodes used for the COLPLAN model

Dummy	BRUN	BOKA	BOKB	CHNA	MUZF	PATR	TENU	KHLG	TALC	TALS	IBVL	FRKK	BNDL	BGBG	DRGL	DRGC	KLGT	MEJI	MLJR	NCOS	SNTD	SGEN	TITG	BONG
RNJ	1	0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
JHA	1	1	1	1	1	0	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0
EBK	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WBK	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SNG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WRD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NAG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NKN	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SKN	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RMG	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GDH	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAJ	1	0	0	0	1	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0
TLC	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
IBV	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
KRB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SHG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GDV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NEC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
KRW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MRG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOMB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JNPT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Dummy	BRUN	BOKA	BOKB	CHNA	MUZF	PATR	TENU	KHLG	TALC	TALS	IBVL	FRKK	BNDL	BGBG	DRGL	DRGC	KLGT	MEJI	MLJR	NCOS	SNTD	SGEN	TITG	BONG
KNDL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VADI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MANG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MORM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIPV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CALC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PARA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUTN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VSKN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HALD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TLP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JHH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RNH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IBP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IBZ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KRP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KRV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MRP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MRV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KWP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Contd./-

Dummy	BDRP	INDP	RAJG	FRDB	PNPT	BHTN	LHMO	ROPR	KOTA	SRTG	BARS	DADR	RIHN	SING	TNDA	UNCH	ANPA	HRDG	OBRA	PNKI	PARI	BAKR
RNJ	1	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1	0	1	0	0	1	1
JHA	1	0	1	0	1	1	1	1	1	0	0	1	0	0	1	1	0	1	0	1	1	0
EBK	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
WBK	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0
SNG	0	0	0	1	0	0	0	0	1	1	0	0	1	1	0	1	1	0	1	0	1	0
PEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WRD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NAG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NKN	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	0	1	1	1	1	0
SKN	1	1	1	1	1	1	1	1	1	0	0	1	0	0	1	1	0	1	0	1	1	0
RMG	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
GDH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IBV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KRB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SHG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GDV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NEC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KRW	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
MRG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOMB	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0
COCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JNPT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KNDL	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0

Dummy	BDRP	INDP	RAJG	FRDB	PNPT	BHTN	LHMO	ROPR	KOTA	SRTG	BARS	DADR	RIHN	SING	TNDA	UNCH	ANPA	HRDG	OBRA	PNKI	PARI	BAKR
VADI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MANG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MORM	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0
PIPV	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0
CALC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PARA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUTN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VSKN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HALD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TLP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JHH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RNH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IBP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IBZ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KRP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KRV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MRP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MRV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KWP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Contd./-

Dummy	KOTH	NELL	RAMB	RAYL	VJWD	RAMS	RACH	ENNO	METT	NMAD	TUTI	GDHN	SABR	SIKK	UKAI	WNKB	AMKT	KORE	KORW	BRSN	SATP	KORS	VNDH
RNJ	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JHA	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
EBK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WBK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SNG	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
PEN	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
WRD	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NAG	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
NKN	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SKN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RMG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GDH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TLC	1	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
IBV	1	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
KRB	0	0	0	0	1	0	1	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	0
SHG	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0
GDV	1	1	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NEC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KRW	1	0	0	0	1	0	0	1	0	0	0	1	1	1	1	1	1	0	0	1	1	0	0
MRG	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
BOMB	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	0
COCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JNPT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KNDL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	0

Dummy	KOTH	NELL	RAMB	RAYL	VJWD	RAMS	RACH	ENNO	METT	NMAD	TUTI	GDHN	SABR	SIKK	UKAI	WNKB	AMKT	KORE	KORW	BRSN	SATP	KORS	VNDH
VADI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MANG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MORM	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	0
PIPV	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	0
CALC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PARA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUTN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VSKN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HALD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TLP	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
JHH	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
RNH	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
IBP	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
IBZ	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
KRP	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
KRV	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
MRP	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
MRV	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
KWP	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
KWV	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0

Contd./-

Dummy	BHUS	CHNR	DAHN	KPKH	KRDI	NASK	PARS	PARL	TRMB	BALA	IBEX	MAIT	TNGX	TRGL	BHIL	PNCH
RNJ	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
JHA	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0
EBK	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
WBK	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
SNG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PEN	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	1
WRD	0	1	0	0	1	1	1	1	1	0	0	0	0	0	0	0
NAG	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0
NKN	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
SKN	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
RMG	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
GDH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TLC	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
IBV	1	0	0	1	1	1	0	0	0	0	1	0	0	0	0	0
KRB	1	0	1	1	1	1	0	0	1	0	0	0	0	0	1	0
SHG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GDV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NEC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KRW	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
MRG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOMB	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
COCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JNPT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KNDL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Dummy	BHUS	CHNR	DAHN	KPKH	KRDI	NASK	PARS	PARL	TRMB	BALA	IBEX	MAIT	TNGX	TRGL	BHIL	PNCH
VADI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MANG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MORM	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PIPV	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CALC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PARA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUTN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VSKN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HALD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TLP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JHH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RNH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IBP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IBZ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KRP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KRV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MRP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MRV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KWP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KWV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Annexure 3.18 Distance between demand-supply nodes (in kms)

Dummy	BRUN	BOKA	BOKB	CHNA	MUZF	PATR	TENU	KHLG	TALC	TALS	IBVL	FRKK	BNDL	BGBG	DRGL	DRGC	KLGT	MEJI	MLJR	NCOS	SNTD	SGEN	TITG	BONG
RNJ	331.5	224	224	227	436.56	302	301	424	575	575	663	251	219	219	62	62	219	26	240	240	60	240	240	1057
JHA	325	61	61	46	450	130	118	533	460	460	483	464	245	245	221	221	245	186	280	280	130	280	280	1087
EBK	455	27	27	12	558	101	68	481	541	541	439	372	349	349	181	181	349	158	389	389	151	389	389	1087
WBK	325	21	21	16	428	101	95	495	541	541	451	413	245	245	217	217	245	169	280	280	130	280	280	1087
SNG	582	431	431	440	685	324	431	630	649	649	472	596	810	810	577	577	810	401	850	850	612	850	850	1064
PEN	1086	895	895	895	1189	879	895	1106	1100	1100	812	1085	1602	1602	1246	1246	1602	1602	1602	1602	1333	1602	1602	1969
WRD	1546	1421	1421	1421	1649	1390	1421	1566	1100	1100	812	1500	1512	1512	1556	1556	1512	1512	1512	1512	1243	1512	1512	1969
NAG	1390	1246	1246	1246	1493	1215	1246	1410	1010	1010	712	1396	1402	1402	1446	1446	1402	1402	1402	1402	1133	1402	1402	1969
NKN	455	101	101	130	558	20	41	484	474	474	468	489	349	349	200	200	349	214	389	389	151	389	389	1151
SKN	455	101	101	130	558	20	64	484	501	501	491	521	349	349	200	200	349	231	389	389	151	389	389	1151
RMG	455	101	101	130	558	20	61	484	501	501	478	439	349	349	200	200	349	196	389	389	151 .	389	389	1151
GDH	220	131	131	128	320	119	118	489	540	540	521	331	245	245	159	159	245	141	280	280	130	280	280	830
RAJ	122	445	445	472	225	484	445	20	744	744	792	38	297	297	218	218	297	215	337	337	327	337	337	512
TLC	877	541	541	553	980	582	547	809	5	5	199	717	548	548	575	575	548	546	501	501	500	501	501	1175
IBV	697	439	439	489	800	576	537	884	199	199	5	782	583	583	557	557	583	658	536	536	395	536	536	1263
KRB	888	730	730	780	991	879	730	1012	369	369	173	980	774	774	822	822	774	774	727	727	586	727	727	1500
SHG	1138	980	980	1030	1241	1129	980	1262	683	683	413	1220	909	909	1022	1022	909	909	909	909	786	909	909	1640
GDV	1931	1101	1101	1116	2034	1123	1101	1498	1005	1005	712	1517	1353	1353	1116	1116	1353	1353	1353	1353	1050	1353	1353	2595
NEC	1050	1657	1657	1657	1153	1301	1200	1200	2000	2000	2000	1200	1200	1200	1657	1657	1200	1200	1200	1200	1200	1200	1200	500
KRW	1138	980	980	980	1241	1129	980	1262	683	683	413	1220	909	909	1022	1022	909	909	909	909	786	909	909	1640
MRG	757	489	489	489	860	632	489	934	259	259	60	842	643	643	617	617	643	643	643	643	455	643	643	1320
BOMB	1775	1752	1752	1752	1842	1705	1687	1950	1618	1618	1365	2130	2087	2052	1928	1928	1872	1928	2123	2123	1848	2123	2123	2440
COCH	3055	3170	3170	3170	3120	3152	3110	3215	2540	2540	2470	3300	3169	3190	3325	3325	3020	3325	3148	3148	3252	3148	3148	3890
JNPT	1775	1752	1752	1752	1842	1705	1687	1950	1618	1618	1365	2130	2087	2052	1928	1928	1872	1928	2123	2123	1848	2123	2123	2440

Dummy	BRUN	BOKA	BOKB	CHNA	MUZF	PATR	TENU	KHLG	TALC	TALS	IBVL	FRKK	BNDL	BGBG	DRGL	DRGC	KLGT	MEJI	MLIR	NCOS	SNTD	SGEN	TITG	BONG
KNDL	2108	2180	2180	2180	2238	2067	2050	2310	2032	2032	1910	2382	2480	2450	2330	2330	2450	2330	2505	2505	2274	2505	2505	2775
VADI	2108	2180	2180	2180	2238	2067	2050	2310	2032	2032	1910	2382	2480	2450	2330	2330	2450	2330	2505	2505	2274	2505	2505	2775
MANG	3080	3238	3238	3238	3210	3390	3374	3280	2834	2834	2767	3125	3342	3340	3314	3314	3318	3314	3335	3335	3230	3335	3335	3687
MORM	2252	2305	2305	2305	2412	2240	2240	2442	2100	2100	1852	2545	2665	2600	2478	2478	2608	2478	2705	2705	2402	2705	2705	2965
PIPV	2190	2180	2180	2180	2345	2118	2118	2390	2433	2433	2187	2892	2698	2414	2307	2307	2517	2307	2687	2687	2268	2687	2687	2876
CALC	1026	342	342	342	976	426	418	778	703	703	692	322	72	98	212	212	125	212	45	45	285	45	45	802
CHEN	2805	2419	2419	2419	2789	2502	2494	2795	2232	2232	1892	2723	2679	2597	2492	2492	2515	2492	2702	2702	2412	2702	2702	3193
PARA	1422	782	782	782	1187	874	862	1531	242	242	410	755	475	530	635	635	442	635	460	460	728	460	460	1981
TUTN	3026	2940	2940	2940	3146	3040	3022	3305	2686	2686	2496	3236	3200	3155	3035	3035	3072	3035	3202	3202	2953	3202	3202	3674
VSKN	1758	1154	1154	1154	1885	1260	1244	2012	540	540	547	1167	830	917	1027	1027	790	1027	815	815	1097	815	815	2482
HALD	1167	502	502	502	820	612	604	892	578	578	685	440	175	206	340	340	187	340	122	122	422	122	122	1364
TLP	877	541	541	553	980	582	547	809	5	5	199	717	548	548	575	575	548	546	501	501	500	501	501	1175
JHH	325	61	61	46	450	130	118	533	460	460	483	464	245	245	221	221	245	186	280	280	130	280	280	1087
RNH	331.5	224	224	227	436.56	302	301	424	575	575	663	251	219	219	62	62	219	26	240	240	60	240	240	1057
IBP	697	439	439	489	800	576	537	884	199	199	5	782	583	583	557	557	583	658	536	536	395	536	536	1263
IBZ	697	439	439	489	800	576	537	884	199	199	5	782	583	583	557	557	583	658	536	536	395	536	536	1263
KRP	888	730	730	780	991	879	730	1012	369	369	173	980	774	774	822	822	774	774	727	727	586	727	727	1500
KRV	888	730	730	780	991	879	730	1012	369	369	173	980	774	774	822	822	774	774	727	727	586	727	727	1500
MRP	757	489	489	489	860	632	489	934	259	259	60	842	643	643	617	617	643	643	643	643	455	643	643	1320
MRV	757	489	489	489	860	632	489	934	259	259	60	842	643	643	617	617	643	643	643	643	455	643	643	1320
KWP	1138	980	980	980	1241	1129	980	1262	683	683	413	1220	909	909	1022	1022	909	909	909	909	786	909	909	1640
KWV	1138	980	980	980	1241	1129	980	1262	683	683	413	1220	909	909	1022	1022	909	909	909	909	786	909	909	1640

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Dummy	BDRP	INDP	RAJG	FRDB	PNPT	BHTN	LHMO	ROPR	KOTA	SRTG	BARS	DADR	RIHN	SING	TNDA	UNCH	ANPA	HRDG	OBRA	PNKI	PARI	BAKR
RNJ	1205.64	1205.64	1205.64	1199.52	1296.42	1520	1550	1550	1369.86	1520	2049.18	1205.64	625	625	613	656	630	1125.64	642	798	1319	62
JHA	1182	1182	1182	1176	1276	1485	1515	1515	1343	1485	2009	1182	545	545	578	621	585	1102	590	758	1243	221
EBK	1215	1215	1215	1209	1276	1550	1580	1580	1376	1550	1719	1215	570	570	603	646	561	1135	539	791	978	181
WBK	1182	1182	1182	1176	1276	1575	1605	1605	1343	1575	2009	1182	560	560	570	613	544	1102	525	758	946	217
SNG	923	923	923	917	1012	1221	1251	1251	850	1221	1308	923	10	10	357	400	17	843	51	500	698	577
PEN	791	791	791	759	880	1089	1119	1119	528	1089	683	791	690	690	840	830	682	711	758	805	602	1246
WRD	1251	1251	1251	1219	1340	1549	1579	1579	988	1549	1143	1251	974	974	1050	1040	941	1171	1042	925	812	1556
NAG	1095	1095	1095	1063	1184	1393	1423	1423	832	1393	987	1095	836	836	940	930	780	1015	886	815	702	1446
NKN	1234	1234	1234	1466	1304	1462	1492	1492	1376	1462	1719	1234	358	358	555	598	350	1154	323	740	1056	200
SKN	1234	1234	1234	1466	1304	1511	1541	1541	1376	1511	1719	1234	358	358	555	598	350	1154	323	740	1056	200
RMG	1234	1234	1234	1466	1304	1491	1521	1521	1376	1491	1719	1234	358	358	555	598	350	1154	323	791	1056	200
GDH	1182	1182	1182	1176	1271	1460	1490	1490	1343	1460	2009	1182	656	656	570	613	601	1102	599	758	1345	159
RAJ	1163	1163	1163	1157	1252	1461	1491	1491	1324	1461	1845	1163	668	668	551	594	661	1083	650	739	927	218
TLC	1778	1778	1778	1772	1867	2076	2106	2106	1900	2076	1781	1778	874	874	1220	1209	864	1698	825	1334	1008	575
IBV	1354	1354	1354	1322	1443	1652	1682	1682	1500	1652	1571	1354	676	676	1010	1000	666	1274	640	1134	762	557
KRB	1237	1237	1237	1205	1326	1535	1565	1565	1250	1535	1454	1237	577	577	893	883	567	1157	542	1008	663	822
SHG	987	987	987	985	1076	1295	1325	1325	1560	1295	1454	987	386	386	713	703	376	907	351	888	404	1022
GDV	1636	1636	1636	1604	1725	1934	1964	1964	1373	1934	1370	1636	1113	1113	1282	1272	1123	1556	1150	1067	1044	1116
NEC	2050	2050	2050	2050	2200	2400	2430	2430	2000	2400	2299.18	2050	1664	1664	1513	1513	1654	1970	1625	1513	1570	1657
KRW	987	987	987	985	1076	1295	1325	1325	1560	1295	1454	987	386	386	713	703	376	907	351	888	404	1022
MRG	1294	1294	1294	1262	1383	1592	1622	1622	1440	1592	1143	1294	626	626	950	940	616	1214	590	1074	702	617
BOMB	1406	1406	1400	1380	1490	1682	1682	1798	985	1476	1476	1382	1450	1456	1642	1445	1456	1287	1462	1350	1139	1287
COCH	2872	2872	2878	2900	3220	3190	3190	3390	2405	3050	3050	2890	2680	2685	2810	2630	2685	2674	2682	2682	2435	2674
JNPT	1406	1406	1400	1380	1490	1682	1682	1798	985	1476	1476	1382	1450	1456	1642	1445	1456	1287	1462	1350	1139	1287
KNDL	1070	1070	1064	1052	1160	1285	1285	1420	875	1115	1115	1084	1708	1708	1710	1555	1708	1165	1708	1405	1376	1165

Dummy	BDRP	INDP	RAJG	FRDB	PNPT	BHTN	LHMO	ROPR	KOTA	SRTG	BARS	DADR	RIHN	SING	TNDA	UNCH	ANPA	HRDG	OBRA	PNKI	PARI	BAKR
VADI	1070	1070	1064	1052	1160	1285	1285	1420	875	1115	1115	1084	1708	1708	1710	1555	1708	1165	1708	1405	1376	1165
MANG	2830	2830	2824	2804	2913	2992	2992	3130	2335	2640	2640	2802	2576	2576	2855	2685	2576	2690	2576	2555	2355	2690
MORM	2187	2187	2180	2158	2275	2345	2345	2528	1605	1340	1340	2135	1945	1945	2492	2405	1945	2042	1945	2215	1725	2042
PIPV	1375	1375	1368	1345	1465	1412	1412	1682	770	1525	1525	1328	1946	1940	1608	1576	1953	1308	1956	1406	1295	1308
CALC	1458	1458	1451	1422	1553	1870	1870	1755	1780	1867	1867	1416	795	795	926	878	835	1353	835	1005	1236	1353
CHEN	2476	2476	2467	2446	2566	2878	2878	2730	2248	3068	3068	2434	2382	2382	2588	2408	2382	2368	2382	2335	2118	2368
PARA	1680	1680	1671	1650	1772	2020	2020	1985	1466	2076	2076	1638	1337	1337	1208	1100	1337	1575	1337	1238	1318	1575
TUTN	2980	2980	2973	2944	3070	3282	3282	3265	2530	3287	3287	2940	2652	2652	2974	2662	2652	2837	2652	2780	2547	2837
VSKN	1688	1688	1679	1658	1776	2062	2062	1988	1435	1745	1745	1639	1248	1248	1638	1195	1248	1565	1248	1340	1260	1565
HALD	1582	1582	1573	1552	1676	2006	2006	1870	1664	2125	2125	1540	975	975	1049	1003	975	1475	975	1130	1351	1475
TLP	1778	1778	1778	1772	1867	2076	2106	2106	1900	2076	1781	1778	874	874	1220	1209	864	1698	825	1334	1008	575
JHH	1182	1182	1182	1176	1276	1485	1515	1515	1343	1485	2009	1182	545	545	578	621	585	1102	590	758	1243	221
RNH	1205.64	1205.64	1205.64	1199.52	1296.42	1520	1550	1550	1369.86	1520	2049.18	1205.64	625	625	613	656	630	1125.64	642	798	1319	62
IBP	1354	1354	1354	1322	1443	1652	1682	1682	1500	1652	1571	1354	676	676	1010	1000	666	1274	640	1134	762	557
IBZ	1354	1354	1354	1322	1443	1652	1682	1682	1500	1652	1571	1354	676	676	1010	1000	666	1274	640	1134	762	557
KRP	1237	1237	1237	1205	1326	1535	1565	1565	1250	1535	1454	1237	577	577	893	883	567	1157	542	1008	663	822
KRV	1237	1237	1237	1205	1326	1535	1565	1565	1250	1535	1454	1237	577	577	893	883	567	1157	542	1008	663	822
MRP	1294	1294	1294	1262	1383	1592	1622	1622	1440	1592	1143	1294	626	626	950	940	616	1214	590	1074	702	617
MRV	1294	1294	1294	1262	1383	1592	1622	1622	1440	1592	1143	1294	626	626	950	940	616	1214	590	1074	702	617
KWP	987	987	987	985	1076	1295	1325	1325	1560	1295	1454	987	386	386	713	703	376	907	351	888	404	1022
KWV	987	987	987	985	1076	1295	1325	1325	1560	1295	1454	987	386	386	713	703	376	907	351	888	404	1022

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Dummy	KOTH	NELL	RAMB	RAYL	VJWD	RAMS	RACH	ENNO	METT	NMAD	TUTI	GDHN	SABR	SIKK	UKAI	WNKB	AMKT	KORE	KORW	BRSN	SATP	KORS	VNDH
RNJ	1291	2014	1116	2308	1259	1116	1780	1693	2587	2214	2693	1990	1965	2265	1733.98	1731	922	822	822	922	1281	822	625
JHA	1276	2029	1101	2350	1350	1101	1795	1784	2602	2229	2757	1950	1925	2225	1705	1691	868	775	775	868	1231	775	545
EBK	1276	2054	1101	2350	1305	1101	1820	1739	2627	2254	2748	1900	1875	2175	1564	1641	840	730	730	840	1211	730	570
WBK	1276	2079	1101	2350	1350	1101	1845	1784	2652	2279	2783	1900	1875	2175	1705	1641	840	771	771	840	1211	771	560
SNG	1288	2516	1113	2774	1661	1113	2282	2095	3089	2716	2516	1365	1340	1640	1153	1106	362	577	577	362	656	577	10
PEN	665	1015	523	992	695	523	781	1129	1588	1215	1550	1785	1760	2060	766	1526	416	555	555	416	146	555	690
WRD	226	898	143	802	454	143	664	888	1471	1098	1350	1695	1670	1970	756	1436	626	641	641	626	422	641	974
NAG	485	1115	343	912	634	343	881	1068	1688	1315	1460	1585	1560	1860	646	1326	516	491	491	516	222	491	836
NKN	1298	2192	1123	2450	1981	1123	1958	2415	2765	2392	3249	1723	1698	1998	1564	1464	944	879	879	944	1014	879	358
SKN	1298	2192	1123	2450	1981	1123	1958	2415	2765	2392	3249	1723	1698	1998	1564	1464	900	879	879	900	1014	879	358
RMG	1298	2192	1123	2450	1981	1123	1958	2415	2765	2392	3249	1723	1698	1998	1564	1464	870	879	879	870	1014	879	358
GDH	1260	2237	1320	2370	1981	1320	2003	2415	2810	2437	3294	2009	1984	2284	1705	1750	888	812	812	888	1311	812	656
RAJ	1673	2566	1498	2450	1679	1498	2332	2113	3139	2766	3623	1845	1820	2120	1690	1586	945	1012	1012	945	1494	1012	668
TLC	1180	1998	1005	1802	1159	1005	1764	1593	2571	2198	2100	1945	1920	2220	1645	1686	666	461	461	666	1211	461	874
IBV	887	2244	712	2049	1405	712	2010	1839	2817	2444	2339	1647	1622	1922	1395	1388	368	173	173	368	913	173	676
KRB	777	1478	952	2222	1565	952	1244	1999	2051	1678	2535	1548	1523	1823	1296	1289	190	17	17	190	814	17	577
SHG	980	1617	1155	1949	1224	1155	1383	1658	2190	1817	2674	1357	1332	1632	977	1098	80	319	319	80	623	319	386
GDV	10	762	52	526	312	52	528	746	1335	962	1819	1927	1902	2202	988	1668	861	974	974	861	564	974	1113
NEC	3370	3429	3195	3500	3500	3195	3195	3934	5000	3629	4486	2299.18	2299.18	2599.18	2820	2040.18	2100	2100	2100	2100	2564	2100	1664
KRW	980	1617	1155	1949	1224	1155	1383	1658	2190	1817	2674	1357	1332	1632	977	1098	80	319	319	80	532	319	386
MRG	947	2304	772	2109	1465	772	2070	1899	2877	2504	3361	1587	1562	1862	1335	1328	318	123	123	318	853	123	626
BOMB	980	1295	975	1015	1015	975	650	1530	1195	1520	1610	557	586	816	390	472	1314	1329	1329	1085	746	1329	1452
COCH	1600	775	1640	1445	1445	1640	1115	680	360	680	415	1957	1965	2200	1870	1925	2215	2247	2247	2415	1990	2247	2522
JNPT	980	1295	975	1015	1015	975	650	1530	1195	1530	1610	557	580	816	390	472	1314	1329	1329	1085	746	1329	1452
KNDL	1896	2412	1882	1935	1935	1882	1764	2364	2035	2364	2425	378	390	25	660	503	1655	1780	1780	1560	1685	1780	1720

Dummy	KOTH	NELL	RAMB	RAYL	VJWD	RAMS	RACH	ENNO	METT	NMAD	TUTI	GDHN	SABR	SIKK	UKAI	WNKB	AMKT	KORE	KORW	BRSN	SATP	KORS	VNDH
VADI	1896	2412	1882	1935	1935	1882	1764	2364	2035	2364	2425	378	390	25	660	503	1655	1780	1780	1560	1685	1780	1720
MANG	1582	866	1567	1622	1622	1567	962	794	481	794	770	1780	1780	3080	1600	1765	2455	2576	2576	2355	1955	2576	2720
MORM	1182	905	1050	1115	1115	1050	625	960	715	960	1140	1215	1215	1595	1018	1165	1735	1857	1857	1640	1290	1857	2565
PIPV	1906	2390	1902	1900	1900	1902	1740	2668	1952	2668	2404	368	368	715	608	462	1858	2127	2127	1600	1190	2127	1790
CALC	1335	3055	2782	2862	2862	2782	2505	3152	3308	3152	3723	2230	2230	2645	2213	2391	1135	887	887	1235	1450	887	715
CHEN	1120	375	1075	1193	1193	1075	705	10	427	10	566	1921	1921	2244	1878	1945	2150	2393	2393	2043	1668	2393	2668
PARA	1858	2494	1721	1755	1755	1721	1872	2732	2685	2732	2992	1924	1924	2316	1862	2118	687	600	600	787	1186	600	1275
TUTN	1490	750	1474	1548	1548	1474	1120	607	422	607	16	2116	2116	2394	1926	2095	2433	2446	2446	2522	2176	2446	2800
VSKN	1583	2185	1476	1548	1548	1476	1576	2276	2382	2276	2782	1785	1785	2044	1583	1751	665	707	707	765	996	707	1287
HALD	2142	2784	2202	2276	2276	2202	2134	2885	2988	2885	3336	2185	2185	2432	2176	2274	987	883	883	1087	1416	883	842
TLP	1180	1998	1005	1802	1159	1005	1764	201	2571	201	201	1945	1920	2220	1645	1686	666	461	461	666	1211	461	874
JHH	1276	2029	1101	2350	1350	1101	1795	341	2602	341	341	1950	1925	2225	1705	1691	868	775	775	868	1231	775	545
RNH	1291	2014	1116	2308	1259	1116	1780	371	2587	371	371	1990	1965	2265	1733.98	1731	922	822	822	922	1281	822	625
IBP	887	2244	712	2049	1405	712	2010	400	2817	400	400	1647	1622	1922	1395	1388	368	173	173	368	913	173	676
IBZ	887	2244	712	2049	1405	712	2010	562	2817	562	562	1647	1622	1922	1395	1388	368	173	173	368	913	173	676
KRP	777	1478	952	2222	1565	952	1244	570	2051	570	570	1548	1523	1823	1296	1289	190	17	17	190	814	17	577
KRV	777	1478	952	2222	1565	952	1244	815	2051	815	815	1548	1523	1823	1296	1289	190	17	17	190	814	17	577
MRP	947	2304	772	2109	1465	772	2070	460	2877	460	460	1587	1562	1862	1335	1328	318	123	123	318	853	123	626
MRV	947	2304	772	2109	1465	772	2070	502	2877	502	502	1587	1562	1862	1335	1328	318	123	123	318	853	123	626
KWP	980	1617	1155	1949	1224	1155	1383	884	2190	884	884	1357	1332	1632	977	1098	80	319	319	80	532	319	386
KWV	980	1617	1155	1949	1224	1155	1383	940	2190	940	940	1357	1332	1632	977	1098	80	319	319	80	532	319	386

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Dummy	BHUS	CHNR	DAHN	KPKH	KRDI	NASK	PARS	PARL	TRMB	BALA	BHIL	IBEX	MAIT	PNCH	TNGX	TRGL
RNJ	1477.98	1315	1953.98	1208	1208	1733.98	1477.98	1615	1828.98	219	998	663	224	1208	301	2030
JHA	1449	1290	1925	1180	1180	1705	1449	1590	1800	245	951	483	61	1180	118	2045
EBK	1308	1200	1784	1069	1069	1564	1308	1500	1659	349	906	439	27	1069	68	2070
WBK	1449	1220	1925	1077	1077	1705	1449	1520	1800	245	947	451	21	1077	95	2095
SNG	897	750	1373	615	615	1153	897	1050	1248	810	753	472	431	615	431	2532
PEN	510	400	986	101	101	766	510	700	861	1602	305	812	895	101	895	1031
WRD	500	20	976	194	194	756	500	320	851	1512	391	812	1421	194	1421	914
NAG	390	200	866	20	20	646	390	500	741	1402	241	712	1246	20	1246	1131
NKN	1308	1108	1784	1121	1121	1564	1308	1408	1659	349	1055	468	101	1121	41	2208
SKN	1308	1108	1784	1144	1144	1564	1308	1408	1659	349	1055	491	101	1144	64	2208
RMG	1308	1108	1784	1101	1101	1564	1308	1408	1659	349	1055	478	101	1101	61	2208
GDH	1449	1150	1925	1112	1112	1705	1449	1450	1800	245	988	521	131	1112	118	2253
RAJ	1434	1470	1910	1199	1199	1690	1434	1770	1785	297	1188	792	445	1199	445	2582
TLC	1389	1305	1865	1170	1170	1645	1389	1605	1740	548	637	199	541	1170	547	2014
IBV	1139	1007	1615	872	872	1395	1139	1307	1490	583	349	5	439	872	537	2260
KRB	1040	908	1516	773	773	1296	1040	1208	1391	774	250	173	730	773	730	1494
SHG	721	717	1197	582	582	977	721	1017	1072	909	442	413	980	582	980	1633
GDV	732	142	1208	367	367	988	732	442	1083	1353	724	712	1101	367	1101	778
NEC	2564	2564	3040	2564	2564	2820	2564	2864	2915	1200	2276	2000	1657	2564	1200	3445
KRW	721	626	1197	582	582	977	721	926	1072	909	442	413	980	582	980	1633
MRG	1079	947	1555	812	812	1335	1079	1247	1430	643	299	60	489	812	489	2320
BOMB	514	862	190	914	905	235	622	526	78	1872	1456	1365	1848	914	1687	900
COCH	1840	1730	1720	1934	1737	1750	1725	1438	1585	3020	2685	2470	3252	1934	3110	1365
JNPT	514	862	190	914	905	235	622	526	78	1872	1456	1365	1848	914	1687	900
KNDL	1062	1423	610	1910	1913	1055	1264	1256	758	2450	1708	1910	2274	1910	2050	2014

Dummy	BHUS	CHNR	DAHN	KPKH	KRDI	NASK	PARS	PARL	TRMB	BALA	BHIL	IBEX	MAIT	PNCH	TNGX	TRGL
VADI	1062	1423	610	1910	1913	1055	1264	1256	758	2450	1708	1910	2274	1910	2050	2014
MANG	1655	1870	1390	1910	1895	1413	1804	1524	1230	3318	2576	2767	3230	1910	3374	1212
MORM	1010	1225	815	1564	1570	855	1280	1004	665	2608	1945	1852	2402	1564	2240	875
PIPV	892	1665	630	1375	1372	970	1092	1250	770	2517	1940	2187	2268	1375	2118	1990
CALC	1710	1974	2168	1750	1738	2062	1692	1986	2310	125	795	692	285	1750	418	2755
CHEN	1528	1295	1406	1510	1498	1495	1368	1118	1286	2515	2382	1892	2412	1510	2494	955
PARA	1362	1053	1794	1040	1028	1580	1298	1465	1722	442	1337	410	728	1040	862	2122
TUTN	2068	1770	1721	2006	1994	1796	1822	1570	1594	3072	2652	2496	2953	2006	3022	1370
VSKN	1205	837	1580	838	826	1410	987	1237	1572	790	1248	547	1097	838	1244	1826
HALD	1706	1352	2156	1347	1335	2014	1608	1692	2164	187	975	685	422	1347	604	2384
TLP	1389	1305	1865	1170	1170	1645	1389	1605	1740	548	637	199	541	1170	547	2014
JHH	1449	1290	1925	1180	1180	1705	1449	1590	1800	245	951	483	61	1180	118	2045
RNH	1478	1315	1954	1208	1208	1734	1478	1615	1829	219	998	663	224	1208	301	2030
IBP	1139	1007	1615	872	872	1395	1139	1307	1490	583	349	5	439	872	537	2260
IBZ	1139	1007	1615	872	872	1395	1139	1307	1490	583	349	5	439	872	537	2260
KRP	1040	908	1516	773	773	1296	1040	1208	1391	774	250	173	730	773	730	1494
KRV	1040	908	1516	773	773	1296	1040	1208	1391	774	250	173	730	773	730	1494
MRP	1079	947	1555	812	812	1335	1079	1247	1430	643	299	60	489	812	489	2320
MRV	1079	947	1555	812	812	1335	1079	1247	1430	643	299	60	489	812	489	2320
KWP	721	626	1197	582	582	977	721	926	1072	909	442	413	980	582	980	1633
KWV	721	626	1197	582	582	977	721	926	1072	909	442	413	980	582	980	1633

Annexure 4.1 Power

Table 1 Locations and fuel supply points

No.	Power plant location	State	Port	Refinery	LNG Terminal
1	Kothagudem	Andhra Pradesh	Vishakhapatnam	Vizag	Kakinada
2	Ramagundem	Andhra Pradesh	Vishakhapatnam	Vizag	Kakinada
3	Vijayawada	Andhra Pradesh	Vishakhapatnam	Vizag	Kakinada
4	Bokaro	Bihar	Calcutta	Haldia	Kakinada
5	Chandrapura	Bihar	Calcutta	Haldia	Kakinada
6	Khalgaon	Bihar	Calcutta	Barauni	Kakinada
7	Patratu	Bihar	Calcutta	Haldia	Kakinada
8	Santhaldih	Bihar	Calcutta	Haldia	Kakinada
9	Badarpur	Delhi	Kandla	Panipat	Dahej
10	Gandhinagar	Gujarat	Kandla	Baroda	Dahej
11	Ukai	Gujarat	Bombay	Baroda	Hazira
12	Wanakbon	Gujarat	Pipavav	Baroda	Dahej
13	Panipat	Haryana	Kandla	Panipat	Dahej
14	Raichur	Karnataka	Marmagao	Bombay	Dabhol
15	Korba	Madhya Pradesh	Paradip	Vizag	Trombay
16	Birsinghpur	Madhya Pradesh	Paradip	Bina	Trombay
17	Satpura Sami	Madhya Pradesh	Bombay	Bina	Trombay
18	Vindhyachal	Madhya Pradesh	Haldia	Bina	Trombay
19	Bhusawal	Maharashtra	Bombay	Bombay	Trombay
20	Chandrapur	Maharashtra	Bombay	Bina	Trombay
21	Khaparkheda	Maharashtra	Paradip	Bina	Trombay
22	Koradi	Maharashtra	Vizag	Bina	Trombay
23	Nasik	Maharashtra	Bombay	Bombay	Trombay

No.	Power plant location	State	Port	Refinery	LNG Terminal
24	Parli	Maharashtra	Bombay	Bombay	Trombay
25	Trombay	Maharashtra	Bombay	Bombay	Trombay
26	Dahanu	Maharashtra	Bombay	Bombay	Trombay
27	Talcher	Orissa	Paradip	Haldia	Kakinada
28	Ib Valley	Orissa	Paradip	Vizag	Kakinada
29	Bhatinda	Punjab	Kandla	Panipat	Dahej
30	Ropar	Punjab	Bombay	Panipat	Dahej
31	Kota	Rajasthan	Kandla	Mathura	Dahej
32	Mettur	Tamilnadu	Cochin	Cochin	Cochin
33	Tuticorin	Tamilnadu	Tuticorin	Cochin	Cochin
34	North Madras	Tamilnadu	Chennai	Chennai	Ennore
35	Anpara	Uttar Pradesh	Haldia	Haldia	Dahej
36	Dadri	Uttar Pradesh	Kandla	Mathura	Dahej
37	Obra	Uttar Pradesh	Haldia	Haldia	Dahej
38	Rihand	Uttar Pradesh	Haldia	Bina	Dahej
39	Singrauli	Uttar Pradesh	Haldia	Haldia	Dahej
40	Unchahar	Uttar Pradesh	Calcutta	Bina	Dahej
41	Farraka	West Bengal	Calcutta	Haldia	Kakinada
42	Kolaghat	West Bengal	Calcutta	Haldia	Kakinada

Table 2 Imputed Values for Coal in Power sector (Rs/kWh)

	Kothagudem	Ramagundem	Vijayawada	Bokaro A&B	Chandrapura	Khalgaon	Patratu	Santhaldih
Subcritical (imported coal)	1.07	1.10	1.00	0.98	0.98	1.01	1.00	0.96
IGCC (imported coal)	1.34	1.36	1.28	1.27	1.27	1.29	1.29	1.26
CCGT (domestic naphtha)	2.26	2.29	2.21	2.21	2.21	2.17	2.23	2.20
CCGT (imported naphtha)	2.46	2.48	2.39	2.37	2.38	2.40	2.39	2.36
CCGT (domestic naphtha-pipeline)	2.22	2.24	2.18	2.18	2.18	2.15	2.20	2.17
CCGT (imported naphtha - pipeline)	2.41	2.43	2.36	2.35	2.3E+00	2.37	2.36	2.34
CCGT (imported LNG)	1.05	1.05	0.85	1.05	1.05	1.05	1.05	1.05
Imputed Value for coal (Rs/kWh)	1.05	1.05	0.85	0.98	0.98	1.01	1.00	0.96
Fuel chosen	CCGT imported LNG	CCGT imported LNG	CCGT imported LNG	Subcritical imported coal	Subcritical imported coal	Subcritical imported coal	Subcritical imported coal	Subcritical imported coal

	Badarpur	Gandhinagar	Ukai	Wanakbori	Panipat	Raichur	Korba	Sanjay Gandhi
Subcritical (imported coal)	1.21	0.99	0.99	0.97	1.23	1.06	1.05	1.12
IGCC (imported coal)	1.43	1.28	1.28	1.27	1.45	1.33	1.32	1.37
CCGT (domestic naphtha)	2.15	2.16	2.18	2.16	2.15	2.27	2.27	2.21
CCGT (imported naphtha)	2.57	2.38	2.38	2.37	2.59	2.44	2.44	2.50
CCGT (domestic naphtha-pipeline)	2.14	2.15	2.16	2.14	2.12	2.23	2.23	2.18
CCGT (imported naphtha - pipeline)	2.49	2.35	2.35	2.35	2.51	2.40	2.39	2.44
CCGT (imported LNG)	0.97	0.97	0.97	0.97	0.97	1.05	1.05	1.05
Imputed Value for coal (Rs/kWh)	0.97	0.97	0.97	0.97	0.97	1.05	1.05	1.05
Fuel chosen	CCGT imported LNG	CCGT imported LNG	CCGT imported LNG	CCGT imported LNG	CCGT imported LNG	CCGT imported LNG	CCGT imported LNG	CCGT imported LNG

	Satpura Sami	Vindhyachal	Bhusawal	Chandrapur STPS	Khaparkheda	Koradi	Nasik	Parli
Subcritical (imported coal)	1.09	1.08	1.02	1.12	1.13	1.11	0.95	1.05
IGCC (imported coal)	1.35	1.34	1.30	1.37	1.38	1.37	1.25	1.32
CCGT (domestic naphtha)	2.20	2.25	2.22	2.28	2.24	2.26	2.16	2.25
CCGT (imported naphtha)	2.47	2.46	2.41	2.50	2.50	2.49	2.35	2.44
CCGT (domestic naphtha-pipeline)	2.17	2.21	2.19	2.23	2.21	2.22	2.15	2.21
CCGT (imported naphtha - pipeline)	2.42	2.41	2.38	2.44	2.45	2.43	2.33	2.39
CCGT (imported LNG)	1.05	1.05	1.05	1.05	1.05	1.05	0.85	1.05
Imputed Value for coal (Rs/kWh)	1.05	1.05	1.02	1.05	1.05	1.05	0.85	1.05
Fuel chosen	CCGT imported LNG	CCGT imported LNG	Subcritical imported coal	CCGT imported LNG	CCGT imported LNG	CCGT imported LNG	CCGT imported LNG	CCGT imported LNG

	Trombay	Dahanu	Talcher	Ib Valley	Bhatinda	Ropar	Kota	Mettur
Subcritical (imported coal)	0.92	0.92	0.95	1.00	1.21	1.37	1.11	1.00
IGCC (imported coal)	1.22	1.22	1.25	1.28	1.44	1.55	1.37	1.28
CCGT (domestic naphtha)	2.15	2.15	2.22	2.24	2.18	2.17	2.20	2.21
CCGT (imported naphtha)	2.32	2.32	2.35	2.39	2.57	2.70	2.49	2.39
CCGT (domestic naphtha-pipeline)	2.12	2.13	2.19	2.20	2.16	2.15	2.17	2.18
CCGT (imported naphtha - pipeline)	2.30	2.31	2.33	2.36	2.50	2.60	2.44	2.36
CCGT (imported LNG)	0.85	0.85	1.05	1.05	1.05	1.05	0.97	1.05
Imputed Value for coal (Rs/kWh)	0.85	0.85	0.95	1.00	1.05	1.05	0.97	1.00
Fuel chosen	CCGT imported LNG	CCGT imported LNG	Subcritical imported coal	Subcritical imported coal	CCGT imported LNG	CCGT imported LNG	CCGT imported LNG	Subcritical imported coal

	Tuticorin	North Madras	Anpara	Dadri	Obra	Rihand	Singrauli STPS	Unchahar
Subcritical (imported coal)	0.92	0.92	1.09	1.17	1.09	1.09	1.09	1.17
IGCC (imported coal)	1.22	1.22	1.35	1.41	1.35	1.35	1.35	1.41
CCGT (domestic naphtha)	2.21	2.15	2.29	2.17	2.29	2.29	2.29	2.23
CCGT (imported naphtha)	2.32	2.32	2.47	2.54	2.47	2.47	2.47	2.54
CCGT (domestic naphtha-pipeline)	2.18	2.12	2.24	2.15	2.24	2.24	2.24	2.20
CCGT (imported naphtha - pipeline)	2.30	2.29	2.42	2.47	2.42	2.42	2.42	2.47
CCGT (imported LNG)	1.05	1.05	1.05	0.97	1.05	1.05	1.05	1.05
Imputed Value for coal (Rs/kWh)	0.92	0.92	1.05	0.97	1.05	1.05	1.05	1.05
Fuel chosen	Subcritical imported coal	Subcritical imported coal	CCGT imported LNG	CCGT imported LNG	CCGT imported LNG	CCGT imported LNG	CCGT imported LNG	CCGT imported LNG

	Farraka	Kolaghat
Subcritical (imported coal)	0.96	0.92
IGCC (imported coal)	1.25	1.22
CCGT (domestic naphtha)	2.20	2.15
CCGT (imported naphtha)	2.36	2.32
CCGT (domestic naphtha-pipeline)	2.17	2.13
CCGT (imported naphtha - pipeline)	2.34	2.31
CCGT (imported LNG)	1.05	1.05
Imputed Value for coal (Rs/kWh)	0.96	0.92
Fuel chosen	Subcritical imported coal	Subcritical imported coal

Table 3 Competitive pithead price of coal (Rs/ton): Power plant locations in the Southern region

Coalfield	Vijayawada	Raichur	Mettur	Tuticorin	North Madras
Raniganj	350	350	-8	609	457
Jhana	328	387	29	846	694
East Bokaro	360	379	21	-157	12
West Bokaro	328	370	12	-169	3
Singrauli	110	221	-137	-78	-146
Pench-Kahan	787	1059	411	301	536
Wardha Valley	956	1141	493	441	618
Nagpur	830	988	340	364	465
North Karanpura	-8	332	-26	-329	-36
South Karanpura	-8	332	-26	-329	-36
Ramgarh	-8	332	-26	-329	-36
Giridih	-8	316	-42	-344	-51
Rajmahal	97	204	-154	-457	-163
Talcher	462	398	40	496	486
Ib valley	289	314	-44	243	346
Korba	177	734	218	237	227
Sohagpur	416	636	170	-132	161
Godavari	1056	1236	588	160	713
Korea Rewa	416	636	170	17	7
Mand Raigarh	247	293	-65	285	304

Table 4 Competitive pithead price of coal (Rs/ton): Power plant locations in the Western region

Coalfield	Gandhinagar	Ukai	Wanakbori	Bhusawal	Nasik	Parli
Raniganj	155	243	244	485	35	432
Jharia	211	295	297	548	87	491
East Bokaro	228	386	332	646	178	554
West Bokaro	228	295	332	548	87	540
Singrauli	525	674	707	935	466	870
Pench-Kahan	267	946	413	1206	738	1115
Wardha Valley	294	953	476	1213	745	1382
Nagpur	371	1030	553	1290	822	1256
North Karanpura	288	386	456	646	178	619
South Karanpura	288	386	456	646	178	619
Ramgarh	288	386	456	646	178	619
Giridih	191	295	279	548	87	589
Rajmahal	247	297	370	558	90	396
Talcher	212	329	300	590	121	481
Ib valley	328	504	509	765	296	690
Korba	397	574	579	834	366	759
Sohagpur	531	798	713	1058	590	893
Godavari	219	790	313	1050	582	1296
Korea Rewa	531	798	713	1058	590	957
Mand Raigarh	370	546	551	807	339	732

Table 5 Competitive pithead price of coal (Rs/ton): Power plant locations in the Northern, Central and Eastern region

Coalfield	Badarpur	Panipat	Bhatinda	Dadri	Unchahar	Kolaghat
Raniganj	595	531	498	595	1104	1192
Jharia	654	588	565	654	1171	1216
East Bokaro	631	588	519	631	1153	1143
West Bokaro	654	588	502	654	1176	1216
Singrauli	835	773	750	835	1326	820
Pench-Kahan	928	866	843	928	1024	264
Wardha Valley	605	543	520	605	877	327
Nagpur	715	652	629	715	954	404
North Karanpura	617	568	581	617	1187	1143
South Karanpura	617	568	547	617	1187	1143
Ramgarh	617	568	561	617	1187	1143
Giridih	654	591	582	654	1176	1216
Rajmahal	667	605	582	667	1190	1179
Talcher	270	239	291	270	758	1003
Ib valley	533	471	448	533	905	979
Korba	615	553	530	615	987	845
Sohagpur	791	728	698	791	1113	750
Godavari	335	288	340	335	714	439
Korea Rewa	791	728	698	791	1113	750
Mand Raigarh	575	513	490	575	947	937

Annexure 4.2 Cement

Table 1 Locations considered for calculating imputed values for cement production

No.	Cluster	Location	Nearest TPP	State	Port
1	Nalgonda	Macherla	Vijayawada	Andhra Pradesh	Vishakhapatnam
2	-	Khalari	Patratu	Bihar	Calcutta
3	-	Sevalia	Wanakbori	Gujarat	Pipavav
4	-	Gagal	Ropar	Himachal Pradesh	Bombay
5	Satna	Satna	Birsinghpur	Madhya Pradesh	Paradip
6	Bilaspur	Jamul	Korba	Madhya Pradesh	Paradip
7	Chandrapur	Korpana	Chandrapur	Maharashtra	Bombay
8	-	Ratnagiri	Dahanu	Maharashtra	Bombay
9	Chanderia	Shambhupura	Kota	Rajasthan	Kandla
10	-	Sankamagar	Tuticorin	Tamil Nadu	Tuticorin
11	-	Churk	Obra	Uttar Pradesh	Haldia

Table 2 Competitive pithead prices of coal (Rs/ton): Cement

Coalfield	Macherla	Khalari	Sevalia	Satna	Jamul	Korpana	Ratnagiri	Gagal	Shambhupura	Sankamagar	Churk
Raniganj	379	1058	17	850	786	1342	-168	875	523	-421	990
Jharia	315	1178	28	888	819	1435	-158	900	542	-443	1026
East Bokaro	347	1199	63	908	850	1435	-110	854	518	-439	1062
West Bokaro	315	1199	63	908	821	1435	-158	836	542	-451	1072
Singrauli	97	1042	438	1243	957	1192	143	1085	887	-360	1374
Pench-Kahan	775	653	143	1205	973	873	414	1177	1113	18	908
Wardha Valley	944	294	207	1058	913	504	421	855	791	159	709
Nagpur	818	417	284	1135	1018	627	498	964	900	82	818
North Karanpura	-20	1203	187	835	746	1410	-110	916	518	-611	1213
South Karanpura	-20	1203	187	866	746	1410	-110	881	518	-611	1213
Ramgarh	-20	1203	187	887	746	1410	-110	895	518	-611	1213
Gindih	-20	1186	10	874	793	1411	-158	917	542	-626	1020
Rajmahal	85	930	101	834	652	1170	-153	916	555	-739	984
Talcher	449	861	31	1030	1039	1113	-137	637	229	-218	861
Ib valley	277	865	240	1239	1241	1158	-27	782	431	-300	991
Korba	165	653	310	1364	1296	954	42	864	607	-367	1060
Sohagpur	404	478	444	1431	1138	778	266	1033	389	-414	1194
Godavari	1044	482	44	893	679	718	258	685	521	-122	633
Korea Rewa	404	478	444	1431	1138	813	266	1033	389	-414	1194
Mand Raigarh	235	826	282	1274	1276	1158	15	824	474	-649	1026

Imputed values model user manual

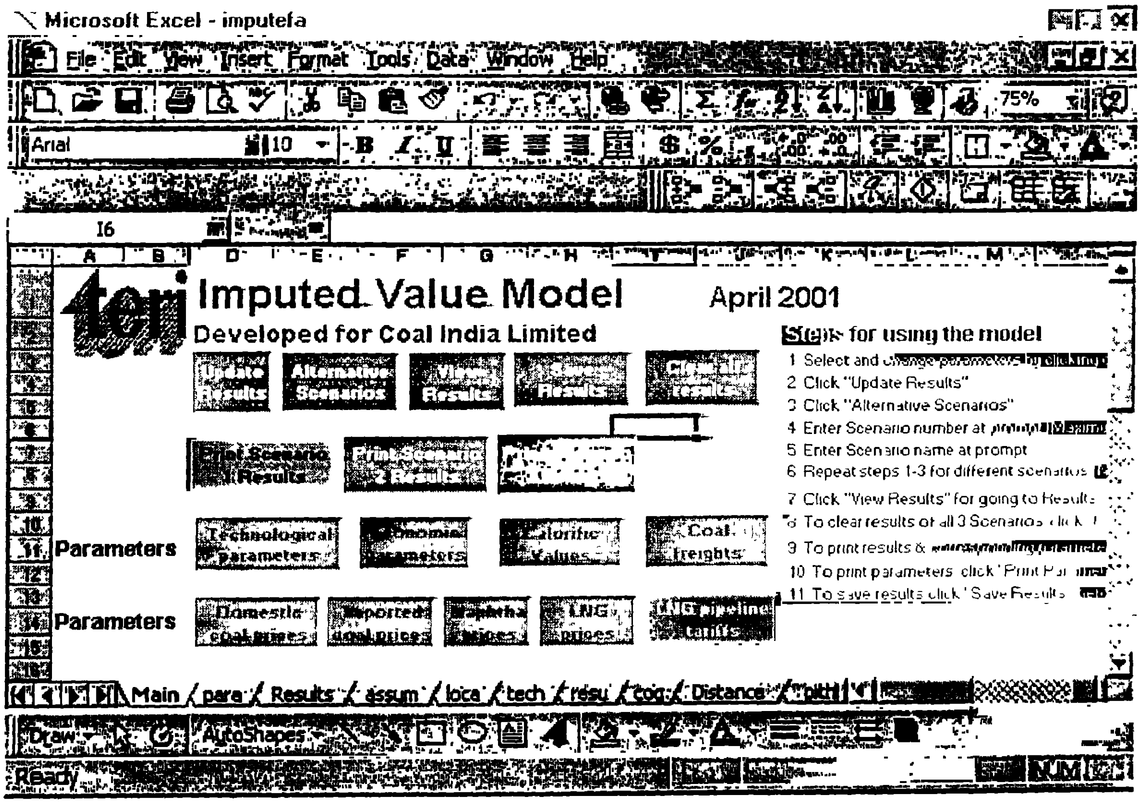
Introduction

The Imputed Values model is a fully automated spreadsheet framework used for calculating the maximum price that can be charged for domestic coal to remain competitive with alternative fuels at distinct consuming locations. Another key output of the model is the calculation of competitive pithead prices or the coalfield-wise maximum pithead prices that can be charged at each location. 42 power plant locations and 21 coalfields have been considered in the model.

Using the model

The model is operated entirely from a single sheet, called the "Main" sheet (please see Figure 1 below). The sheet has several "buttons" which when clicked activate options for changing parameters, running the model and updating the results, building scenarios, viewing results, printing and saving results.

Figure 1 Main sheet



Imputed Value Model April 2001

Developed for Coal India Limited

Parameters

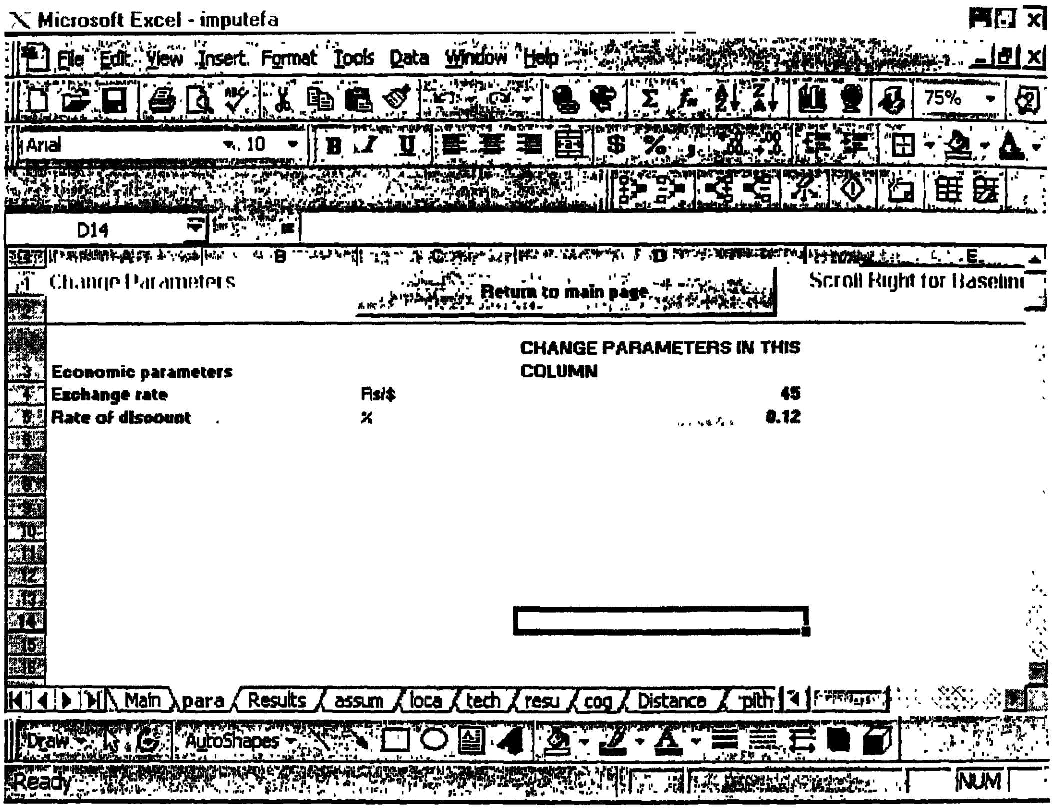
Parameters

Steps for using the model

1 Select and change parameters by clicking
2 Click "Update Results"
3 Click "Alternative Scenarios"
4 Enter Scenario number at prompt
5 Enter Scenario name at prompt
6 Repeat steps 1-3 for different scenarios
7 Click "View Results" for going to Results
8 To clear results of all 3 Scenarios click
9 To print results &
10 To print parameters click 'Print Par
11 To save results click 'Save Results

A set of basic parameters or assumptions have been used for building the baseline for the Imputed Values model. These parameters are all stored in the "Para" sheet (Figure 2 below).

Figure 2 Parameters sheet



Change Parameters

Return to main page

Scroll Right for Baselin

		CHANGE PARAMETERS IN THIS COLUMN
Economic parameters		
Exchange rate	Rs/$	45
Rate of discount	%	0.12

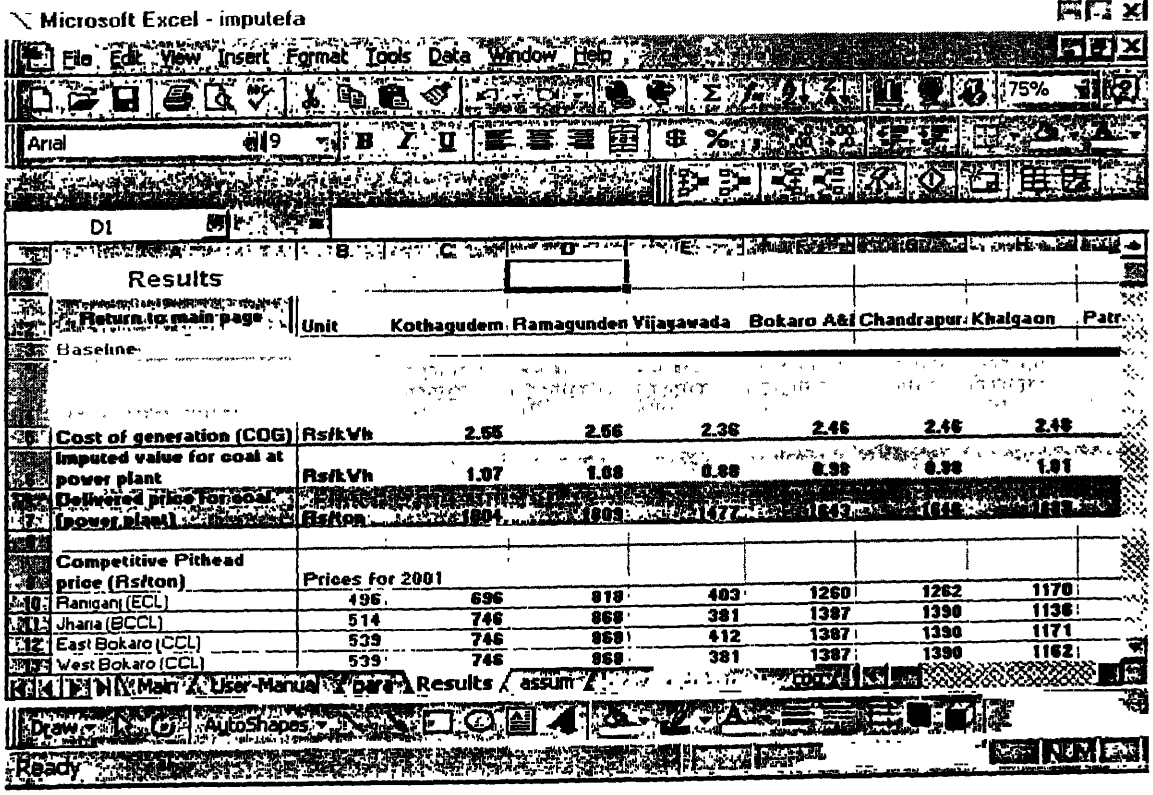
The parameters have been classified into the following categories:

1. *Economic parameters:* Discount Rate and Exchange Rate
2. *Technological parameters:* Plant Load Factor (PLF), Capital Costs and Heat Rates for the different power generation technologies.
3. *Calorific Values:* for indigenous coal, imported coal, naphtha and LNG.
4. *Coal freights:* for different distance slabs.
5. *LNG pipeline tariffs:* for different distance slabs.
6. *Domestic coal prices:* price build-up for domestic coal
7. *Imported coal prices:* price build-up for imported coal
8. *Naphtha prices:* price build-up for naphtha
9. *LNG prices:* price build-up for LNG

Each of the above 9 categories corresponds to a "button" in the Main sheet. The values of any of the parameters can be viewed by clicking on the relevant button which takes the user to the range of cells where these values are stored. For. e.g., clicking on the button for Economic parameters in the Main sheet, will take the user to the cell named 'Economic parameters' in the Para sheet (please see Figure 1).

In case the user wants to retain the parameter assumptions at their baseline values and run the model, the next step is to click on the button called "Update Results" in the Main sheet. This will run the entire model and generate the results. Once the updation of results is completed, the user should click on the button "Alternative Scenarios". Upon clicking this button, a box will appear which will prompt the user to "Enter Scenario Number (1,2 or 3)". The user should enter 1 at this point. This will be followed by another box which will prompt the user to give the "Scenario Description". Here the user should enter "Baseline". This command will make the model pick up and paste the results in the "Results" sheet. This sheet contains the Imputed Values for coal, the best alternative fuel, the cost of generation, the delivered price of coal and the competitive pithead prices of coal supply from each coalfield for each of the 42 power plant locations. These results can be seen by clicking on "View Results" which will take the user to the Results sheet (please see Figure 3 below).

Figure 3 Results sheet



Results

Return to main page	Unit	Kothagudem	Ramagunden	Vijayawada	Bokaro A&I	Chandrapur	Khalgaon	Patr
Baseline								
Cost of generation (COG)	Rs/kWh	2.55	2.56	2.36	2.46	2.46	2.48	
Imputed value for coal at power plant	Rs/kWh	1.07	1.08	0.88	0.98	0.98	1.01	
Delivered price for coal (power plant)	Rs/ton	1804	1809	1477	1643	[illegible]	[illegible]	
Competitive Pithead price (Rs/ton)	Prices for 2001							
Raniganj (ECL)	496	696	818	403	1260	1262	1170	
Jharia (BCCL)	514	746	868	381	1387	1390	1136	
East Bokaro (CCL)	539	746	868	412	1387	1390	1171	
West Bokaro (CCL)	539	746	868	381	1387	1390	1162	

To build alternative scenarios, the user can change any of the parameter values to the desired value, run the model and generate an alternative set of results. For this, the first step is to select the parameter to be changed by clicking on the relevant button and changing the parameter value. For e.g., if the exchange rate is to be changed from the baseline value of 45 Rs/$ to say 47 Rs/$, click on "Economic parameters" in the Main sheet, which takes you to the Para sheet, where the value should be changed to 47 in the cell where 45 is entered at present. Similarly, the values of any of the parameters can be changed to represent different scenarios.

Once the user has made the desired changes in parameter values, the next step is to run the model and generate the results for this alternative scenario. As earlier, the user should click on "Update Results", which will run and generate the new set of results. Then the "Alternative Scenarios" button should be clicked and at the prompt, the user should enter the scenario number as 2, to distinguish this scenario from the baseline. Further, the "Scenario Description" should be chosen to represent the new scenario, for e.g., "Higher exchange rate". This will paste the results in a block below the Baseline scenario, to enable a comparison between the two results. The model can accommodate a maximum of 3 scenarios.

The model also simplifies printing of Results and their corresponding parameters, with buttons provided for printing the results of the three scenarios separately. The date and time of printing will appear on the top of these sheets, to enable keeping a track of changes in parameters and results corresponding to different scenarios.

Once alternative scenarios have been generated and the results viewed, if the user wants to save these results, they should click on the button "Save Results" before closing the file. Incase the user wants to generate new scenarios, they can "Clear all results", which will clear the existing values in the Results sheet for all 3 scenarios. The user then repeats the procedure from the beginning for changing parameters, updating results, naming the scenarios and viewing the results.

Further, the Baseline assumptions have been included in the Parameters sheet, to provide an easy reference in case the user wants to bring the model back to its baseline.

A summary of the steps involved in running the Imputed Values model is presented in Box 1 below.

Box 1 Steps for using the Imputed Values model

1. Select and change parameters by clicking on relevant buttons
2. Click "Update Results"
3. Click "Alternative Scenarios"
4. Enter Scenario number at prompt (Maximum 3 scenarios)
5. Enter Scenario name at prompt
6. Repeat steps 1-3 for different scenarios (Maximum 3 scenarios)
7. Click "View Results" for going to Results sheet (Scroll down for different scenario results)
8. To clear results of all 3 Scenarios, click "Clear all results" (then begin from Step 1 for changing parameters)
9. To print results and the corresponding parameters, click "Print Scenario 1/2/3 Results"
10. To save results click "Save Results" before exiting

Further notes

In addition to the three basic sheets, Main, Para and Results; there are other sheets in the model which are linked to these three sheets. These are briefly explained below:

1. *Assumptions sheet ("Assum"):* Contains all assumptions on fuel price build up and calorific values, which are linked to the parameters sheet.
2. *Locations sheet ("Loca"):* Calculates transportation costs for the different fuels from the nearest supply source for that fuel, again linked to freight rates and pipeline tariffs in the parameters sheet.
3. *Technology sheet ("Tech"):* This sheet calculates the Imputed values for coal for different power generation technologies based on the technological parameters in the Parameters sheet.
4. *Detailed Results sheet ("Resu"):* Gives Imputed Values results for all technologies and fuels for all the locations. From this detailed sheet, the summary results are pasted in the Results sheet.
5. *Cost of generation sheet ("Cog"):* Gives the Cost of power generation for different technologies and fuels for all the locations
6. *Distance sheet:* The distance matrix from ports, refineries and LNG terminals to each power plant location. Distances are picked up from here calculating the fuel transportation costs.
7. *Pithead prices sheet:* Calculation of competitive pithead prices is done in this sheet. Summary results are pasted into the Results sheet from here.
8. *Coal transportation cost ("Coal tpt cost"):* Calculates coal transportation costs based on freight rates from the parameters sheet and distances from the Coalfields sheet.

9. *Coalfields:* Distance matrix from coalfields to each of the power plant locations.

For running and using the model, the user should operate the model from the Main and Para sheet, and should not alter data in these other sheets as this could cause an error in the linkage between sheets and result in a problem in running the model.

Statistical measures & their inference

What is regression?

Regression Analysis is the study of the dependence of one variable (Y) on one or more variables (X/X's), with a view to estimate and/or predict the mean or the average value of the former in terms of the known values of the latter.

The variable that depends on a single or a set of variables is known as the **DEPENDENT/EXPLAINED/REGRESSAND** (Y) variable, and the variables that serve to explain the dependence (X's), are known as the **INDEPENDENT/EXPLANATORY/REGRESSOR** variables.

A simple regression equation is written as follows:

$$Y_t = a + bX_t + u_t$$

Where Y_t...Dependent/Explained/Regressand variable
X_t...Independent/Explanatory/Regressor
u_t...Error Term (technically known as the '*Stochastic Disturbance*', this term captures the difference between the actual values and the fitted/average values)

On obtaining the *'estimates'*, i.e., the values of 'a' and 'b', the results are read as: *a unit increase in X, would lead to 'b' times, an increase (if 'b' is positive) or a decrease (if 'b' is negative) in Y.*

The commonly used regression model is the **CLASSICAL LINEAR REGRESSION MODEL (CLRM)**. This model provides the 'estimates' (i.e. **'a'** and **'b'** in the above equation) and also shows whether the estimates so obtained are the right ones or not. In other words, it shows whether the estimates captured, fit the data well. This procedure of verification is known as **INFERENCE.**

There is a whole array of statistical tools, each of which is known as a **STATISTIC**, which enables Inference. The most basic of these are the t-statistic, F-statistic and R-squared.

These and other terms of common usage, are briefly discussed below:

Standard error of coefficients

Standard error (s.e) is a measure which indicates the precision-levels of the estimate. A high standard error indicates low levels of precision and vice versa. All software packages estimate the s.e for all variables.

Degrees of freedom

The degrees of freedom (df) of a data set is the difference between the total number of observations (no. of years etc) in the sample and the total number of parameters (coefficients of the independent variables) in the model.
The higher the degrees of freedom, better is the model fit, hence more precise the estimates.

R-Squared

R-squared is a measure showing the *goodness of fit* of the model. It shows how much of the dependent/explained variable (Y), is *explained* by the independent/explanatory variable (X).

The R-squared takes the value between 0 and 1 and the goodness of fit is said to increase as R-squared approaches 1.

Adjusted R-Squared

This measure is reported primarily for multiple regression models (eg. $Y_t = a_0 + a_1X_{1t} + a_2X_{2t} ...a_n X_{nt} + u_t$) where there are more than 2 independent variables.

An important property of R-squared is that, it is a non-decreasing function of the number of independent/explanatory variables in the model, as a result of which, an increase in the number of these variables, invariably increases the R-squared. Such a result is misleading. Hence, in order to watch against such results, the Adjusted R-Squared is calculated. An adjustment for the number of variables, as reflected in the degrees of freedom (df), is made to the R-squared which finally yields the Adjusted R-squared.

The Adjusted R-squared gives the precise and reliable *goodness of fit* for a model.

Tests of hypothesis

In very simple terms, a hypothesis can be defined as a statement made on a specific or a group of parameters.

Example:

The following simple linear regression model is based on the Keynesian Income hypothesis, which postulates that consumption is a function of income (meaning that consumption depends on the income variable).

$\mathbf{Y_t = a + bX_t + u_t}$

The value of 'b' in the model is universally accepted to be 0.8 implying that, for a unit increase in the income, consumption increases by 0.8 times. Hence given a data set of consumption and income, one can estimate 'b' and verify whether it coincides with the value which is expected to hold (in this case 0.8). In other words, one can see whether the estimate obtained, conforms to the hypothesis of b=0.8. This process is known as hypothesis testing.

The hypothesis is set as follows:

H_0: b=0.8...Null Hypothesis

H_1: b≠0.8...Alternative Hypothesis

H_0 is known as the *null hypothesis* while H_1 is the *alternative hypothesis*: the former proposes that b takes the value 0.8 while the latter proposes that it takes a value either below or greater than 0.8.

By performing statistical tests (e.g. t test, F test etc), the relevant hypothesis (that is, whether H_0 or H_1) for the model is arrived at.

The following are most common types of hypotheses testing.

t-statistic

The t-statistic is a test of hypothesis. It is set on a single coefficient/parameter (i.e., 'a' or 'b'). Usually the Null hypothesis is set as **H_0: b=0**. The t-statistic for this is calculated as

t = b/s.e (b)

s.e...standard error

By computing the above and by comparing the same with the t-tables for the specified degrees of freedom, one can accept or reject the null hypothesis. If the t-value obtained as above is greater than the t-value given in the tables, then it can be said that the estimate obtained is *statistically significant*, thereby one can reject the null hypothesis.

Note that, the null hypothesis proposes that the value of b will be zero. Hence in our example of consumption-income, if b takes the value of zero, it would imply that income does not have any significant effect on the dependent variable consumption. By verifying with the t-statistic and if it is known that the t-computed is greater than the t-tabulated, we *reject* the null which proposes that the impact of income on consumption is zero, and *accept* the alternative hypothesis (which proposes that income *does* have a significant effect on consumption hence $b \neq 0$).

All software packages compute the t-statistic for the null hypothesis H_0: $b=0$ thus making verification an easy process.

F-statistic

Also known as the Fisher test, the F statistic is a *joint* test hypothesis which indicates whether all the variables taken to explain the dependent variable, are *jointly* relevant for the model. Note that this is applicable only in multiple regression models where the dependent variables are more than one.
Typically, a hypothesis for the F-test for the multiple regression model:

$$Y_t = a_0 + a_1X_{1t} + a_2X_{2t} \ldots a_n X_{nt} + u_t$$

takes the following form:

$$H_0 : a_1+a_2+\ldots+a_n = 0$$

H_1 : atleast one is not equal to zero/not all are equal to zero.

As with the t-statistic, if the computed value is greater than the value in the Fisher tables, the null hypothesis is rejected implying that not all a's (coefficients) are zero. In other words, we conclude that all or some of the independent variables have an impact on the dependent variable. Conversely, when the computed F value is lesser than the tabulated F-value, we conclude that all variables taken to explain the dependent variable are insignificant or do not impact the same.

Akaike information criterion

Information criterion is a measure of information that strikes a balance between the measure of goodness of fit and parsimonious specification of the model. A model is deemed to be good when the dependent variables employed are few and when the R-squared reflects a good fit.

There are different information-criterion measures, of which the widely used ones are the *Akaike Information Criterion (AIC)* and the *Schwarz criterion.*

Both these are calculated taking the number of the observations, the number of variables/regressors and the number of lags employed in the model. These measures essentially try to strike a balance between the number of lags and the number of variables, in relation to the number of observations in the model so as to ensure the best fit for the model.

A low AIC or Schwarz measure would imply that the model satisfies the essential condition of parsimony besides proving to be a good fit. It would substantiate the fact that independent variables chosen are the crucial factors affecting the dependent variable.

Durbin-watson statistic

The Durbin-Watson (DW) statistic finds its use in time-series analysis. It serves to indicate whether there is any positive or negative correlation between the residuals of the time-series. It is primarily a test for first-order serial correlation [AR (1)] which provides a measure for any linear association between adjacent residuals from a regression model.

Linear association between the residuals implies that there are cause-effect relationships between the residuals or the set of variables which are clubbed together under the error term 'u'. Such linearity would lead to faulty regression estimates. The Durbin-Watson comes in handy here to test for the presence of such correlation.

The DW statistic is computed by most software packages; the value of DW typically lies between the bounds of 0 and 4. *If there is no serial correlation, the DW statistic will be around 2.* The DW statistic will fall below 2 if there is positive serial correlation (in the worst case, it will be near zero). If there is negative correlation, the statistic will lie somewhere between 2 and 4.

Note: (Tables of t-statistic, F-statistic and DW statistic are attached herewith.)

Further readings:

1. Gujarati, Damodar.N : "Basic Econometrics", IIIrd Edition, McGraw Hill Book Co.
2. Johnston, J: "Econometric Methods" –Auckland, McGraw Hill International, 1988
3. Greene, W.H: "Econometric Analysis"—3rd ed.—New Jersey, Prentice Hall International, 1997.